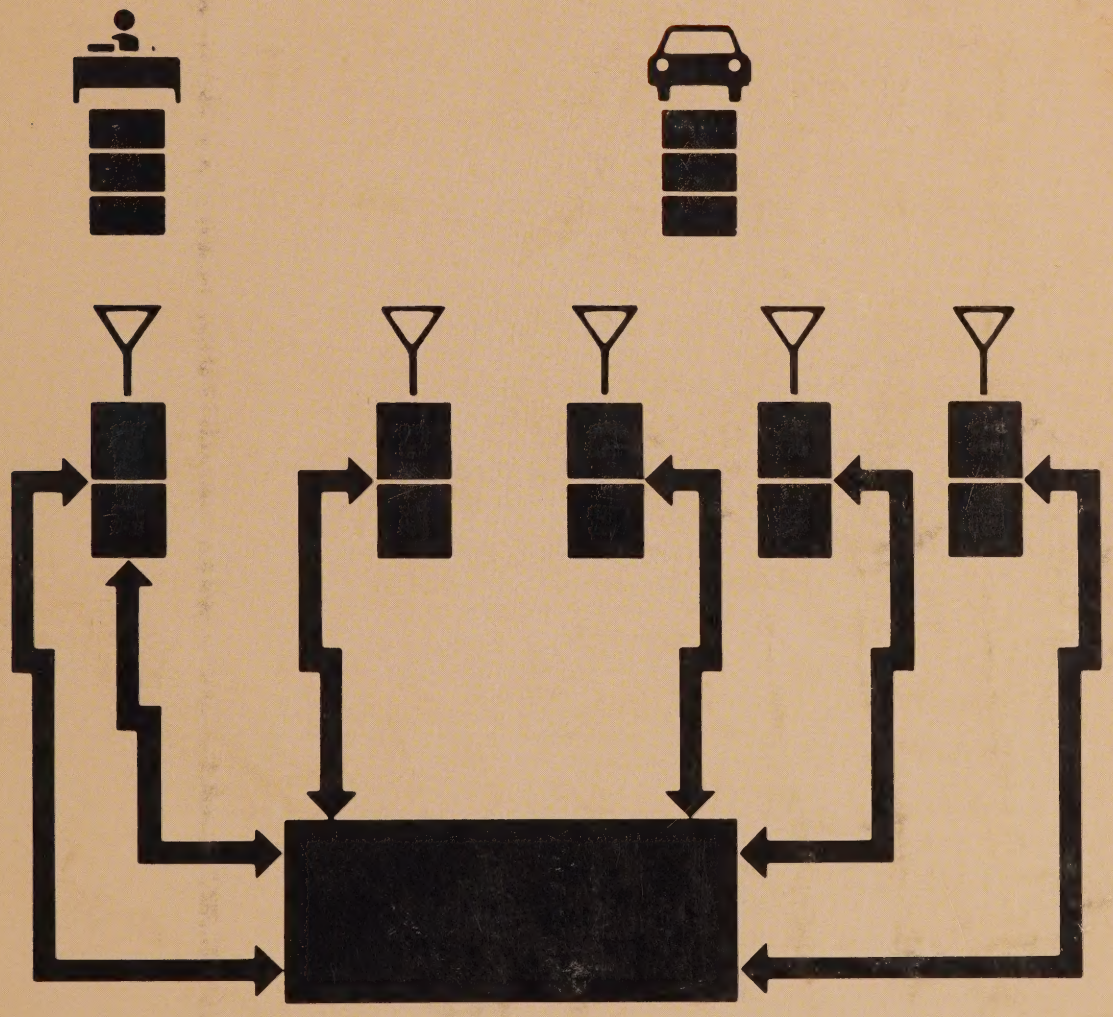
MOTOROLA

SYSTEM MANAGER'S OPERATING MANUAL

For Trunked Radio Systems

Models T5004 Privacy Plus™
and T5076 Smartnet™ Central Controllers
and T4051, T4052, and Options D163 and D401
Central Controller &
Central Interconnect Terminal



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MOTOROLA INC.
Communications
Sector

SYSTEM MANAGER'S OPERATING MANUAL

FOR TRUNKED RADIO SYSTEMS
MODELS T5004 *PRIVACY PLUS*
AND T5076 *SMARTNET* CENTRAL CONTROLLERS
AND T4051, T4052, AND OPTIONS D163 AND D401
CENTRAL CONTROLLER &
CENTRAL INTERCONNECT TERMINAL

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1. GENERAL

This operating manual explains how the system manager's terminal is used to communicate with an interactive computer program used by the Motorola Trunked Radio System. The program enables the system manager's terminal to perform various functions, such as: equipment and status alarm reporting; adjustment of the system timing parameters; channel activity status reporting; etc. The name of the interactive system control program is GUARDIAN (GRD).

Each command that can be entered via the system manager terminal is explained and typical examples are given. This operating manual shows how to interpret the various messages provided by the system. Also discussed are: the automatic system alarm capability; relay-activated external alarms; and the fleet partitioning structure of the trunked radio system.

All system firmware (EPROMs) must be of the same model version for proper system operation. For example, B version MCB firmware must be run with B version CSC firmware as well as B version PLIB firmware. Any combinations of A and B version firmware cause improper system operation. (Refer to the Trunked System Central Interconnect Terminal manual 68P81063E20 for firmware kit numbers.)

2. SYSTEM CONTROL INTERFACE PROGRAM

2.1 INTRODUCTION

The Motorola Trunked Radio System employs an interactive computer program that allows the system manager to use the system manager's terminal to query the status of the trunked system base repeaters. In addition, it allows the system manager to enable or disable the base repeaters. The computer program also allows the system manager to modify, as desired, selected system operating characteristics.

The computer program, named GUARDIAN, is accessed via an RS-232-C terminal connector located on the backplane of the Central Interconnect Terminal for Models T4051 & T4052 and the back of the Central Controller for Model T5004. Refer to the RS-232-C system manager terminal connector in Figure 1.

The system manager's terminal can be either locally emplaced (within 50 cable feet, maximum, of the central controller) or remotely linked, via dedicated telephone lines and modems.

2.2 SYSTEM MANAGER CAPABILITIES

2.2.1 Introduction

A system manager terminal provides the following functions:

All Models

- equipment status and alarm reporting
- individual channel on/off capability
- adjustment of the system timing parameters (optional)
- channel activity status reporting
- date and time information entry for event testing
- entry of fleets on the (optional) negative subscriber list to selectively deny system access to those fleets
- adjustment of shared service algorithm
- interconnect activity status

Models T4051 & T4052

- individual interconnect circuit on/off capability
- entry of individuals on the positive subscriber list to selectively enable access to interconnect
- entry of airtime and TELCO billing parameters
- airtime and TELCO charge reporting

2.2.2 Data Format and Transmission

All communication between the trunked system central controller and the system manager's terminal (or other peripheral equipment) employs unformatted strings of asynchronous ASCII characters. Each character frame comprises 10 bits having the following structure.

- a single start bit
- an 8-bit information field
- a single stop bit

The 8-bit information field consists of a 7-bit ASCII character code and an eighth bit that is always a zero. No parity bit is generated by the central controller, and any parity bit accompanying transmissions from the terminal or other peripheral device is ignored. Refer to Table 1 for a complete ASCII character set.

The system manager's terminal/central controller communications link baud rate is selectable by a jumper located on the master controller (MCB) board module for Models T4051 & T4052 and on the central site controller (CSC) board module for Model T5004. Any one of the following baud rates can be selected: 110, 300, 600, 1200, 1800, 2400, 3600, or 4800. Provisions for programming higher data rates are also contained on the MCB board for Models T4051 & T4052 and on the CSC for Model T5004. However, data rates in excess of 4800 baud should not be used at the system manager's terminal.

2.3 HARDWARE REQUIREMENTS

2.3.1 System Manager's Terminal

The keyboard terminal should have the following characteristics:

- Rate: up to 4800 baud (hardcopy terminals are typically limited to 300 to 1200 baud)
- Communication: RS-232-C link.

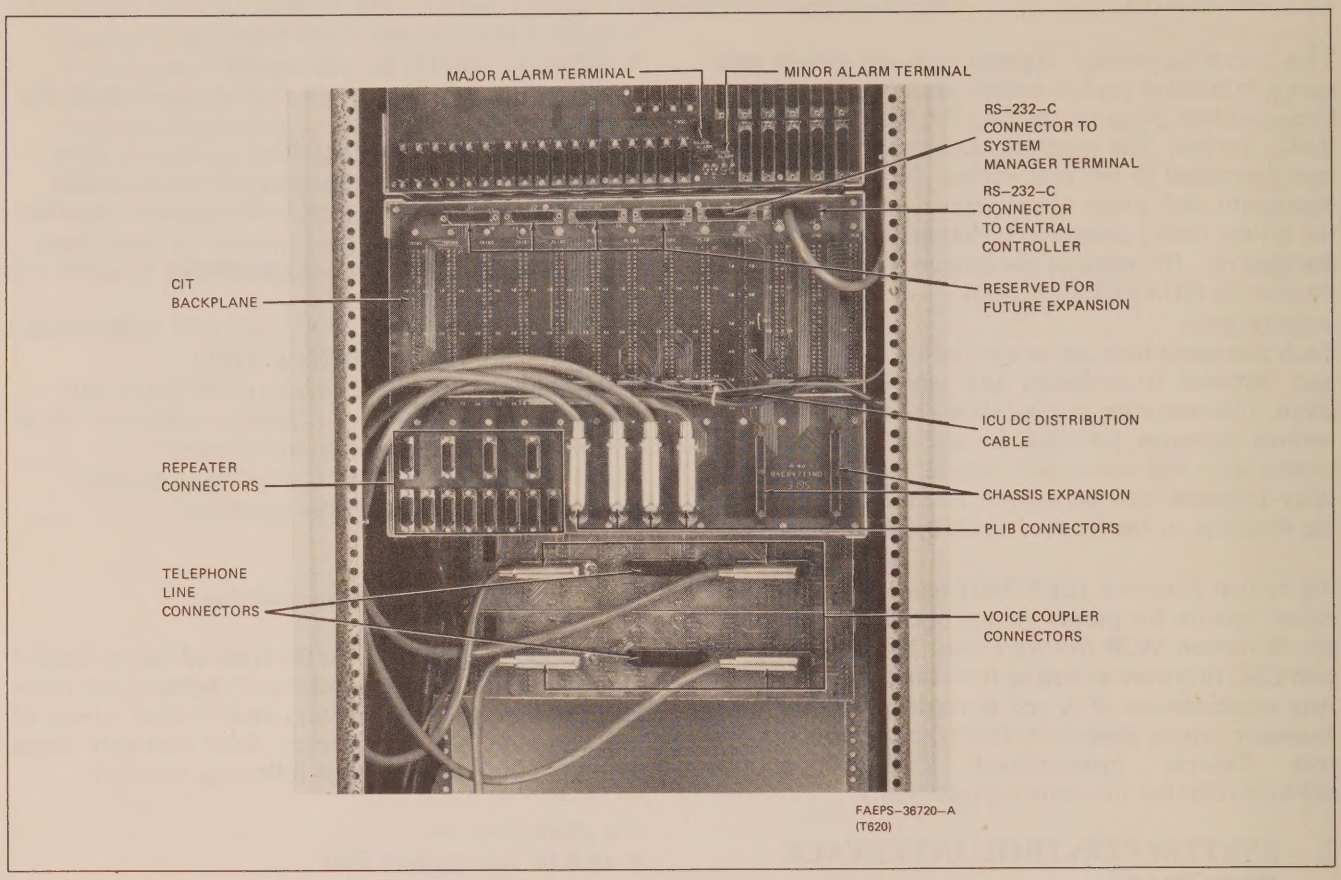

Figure 1A. Models T4051, T4052 Connector Locations

NOTE

A Texas Instruments Model 700 or 765 Terminal meets these requirements. This terminal or equivalent is recommended.

2.3.2 Null Modem Cabling

If the terminal is connected directly to the trunked central controller via a cable (50 feet maximum), a null modem cable is required at the trunked central controller. Refer to Figure 2 for construction details.

The terminal can be remotely linked to the central controller via telephone lines and modems. In this configuration, a standard RS-232-C cable connects the trunked central controller to the modem at the site. This cable is not a null modem cable. A standard RS-232-C cable can be purchased at a local computer supply store.

2.3.3 Modems

Modems used to remotely link the terminal to the trunked central controller should have the following characteristics:

- Rate: up to 4800 baud (must be consistent with baud rate of terminal) — limited to 300 to 1200 baud for hard copy
- Modulation: frequency-shift keying (FSK)
- Communication: asynchronous, duplex
- Line interface: two-wire (dedicated or dial up)
- Terminal interface: RS-232-C

NOTE

The Bell System Model 103A Modem meets the 300 baud requirements. This modem or equivalent can be used.

Modems should be carefully selected to insure their compatibility with the equipment to which they are interfaced. The basic requirement is that the modems must provide for asynchronous, full duplex communications between the trunked system central controller and the system manager's terminal or other peripheral device.

The modem baud rate must also be carefully selected to satisfy the intended application.

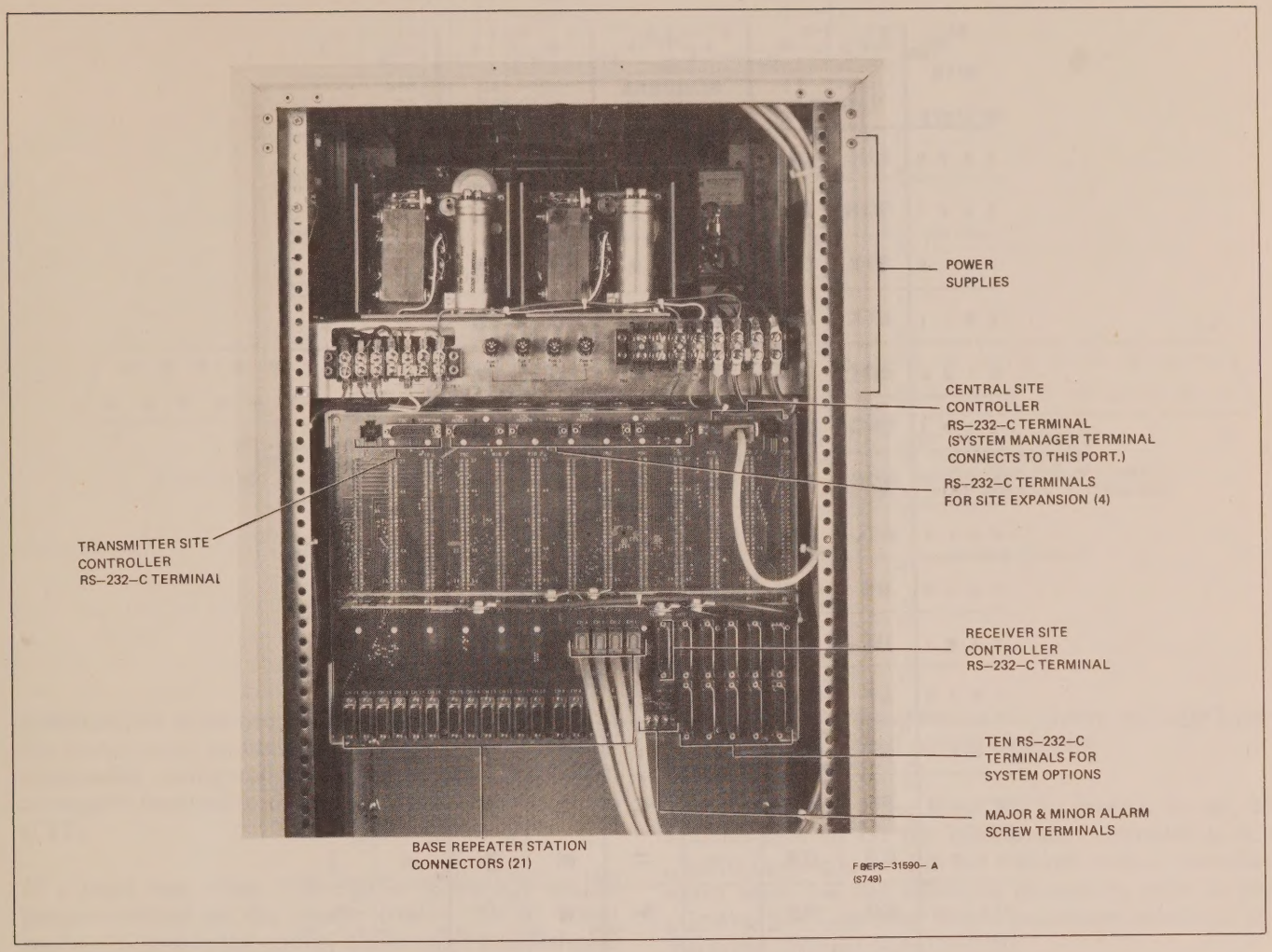
POWER SUPPLIES
CENTRAL SITE CONTROLLER RS–232–C TERMINAL (SYSTEM MANAGER TERMINAL CONNECTS TO THIS PORT.)
RS–232–C TERMINALS FOR SITE EXPANSION (4)
TRANSMITTER SITE CONTROLLER RS–232–C TERMINAL
RECEIVER SITE CONTROLLER RS–232–C TERMINAL
TEN RS–232–C TERMINALS FOR SYSTEM OPTIONS
MAJOR & MINOR ALARM SCREW TERMINALS
BASE REPEATER STATION CONNECTORS (21)
F8EPS–31590– A
(S749)

Figure 1B. Model T5004 Connector Locations

For low-speed asynchronous data communication (1200 baud or less), straightforward FSK modulation techniques are used, and full duplex communication can occur on a leased two-wire telephone company circuit. These low-speed modems generally operate over unconditioned, voice-grade lines. However, the grade of telephone line conditioning requirements must conform to the specifications set by the modem manufacturer.

Modems that operate at higher data rates are more expensive. Moreover, they may require the use of improved grade lines. Full duplex operation requirements can be satisfied only by leasing a 4-wire telephone company circuit.

Modems operating at baud rate of 1800 usually employ more sophisticated modulation schemes and operate in a synchronous mode. Consequently, some form of synchronous-to-asynchronous conversion device would be required. Again, 4-wire conditioned telephone company lines should be used.

When the lines are leased from a telephone company that provides a data communication service, it is strongly recommended that the modems (or data sets) be also leased from the carrier. This arrangement may reduce any problems that could arise between the telephone company and the user, should the data communication link (modems and leased lines) fail to operate in a satisfactory manner.

2.3.4 Other Peripheral Devices

In most applications, the peripheral device connected to the system manager's interface consists of a keyboard terminal with either hard-copy capability or CRT display.

2.3.5 T4051 & T4052 Central Interconnect Terminal Adjustments

When an RS-232-C terminal is locally connected by plugging it into the CSC RS-232-C connector (Figure 1A), or is remotely linked via modems, and is set to

B7 B6 B5 BITS / B4 B3 B2 B1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	CONTROL		NUMBERS SYMBOLS		UPPER CASE		LOWER CASE	
0 0 0 0	0 NUL 0 0	20 DLE 10 16	40 SP 20 32	60 0 30 48	100 @ 40 64	120 P 50 80	140 ` 60 96	160 p 70 112
0 0 0 1	1 SOH 1 1	21 DC1 11 17	41 ! 21 33	61 1 31 49	101 A 41 65	121 Q 51 81	141 a 61 97	161 q 71 113
0 0 1 0	2 STX 2 2	22 DC2 12 18	42 " 22 34	62 2 32 50	102 B 42 66	122 R 52 82	142 b 62 9	162 r 72 114
0 0 1 1	3 ETX 3 3	23 DC3 13 19	43 # 23 35	63 3 33 51	103 C 43 67	123 S 53 83	143 c 63 99	163 s 73 115
0 1 0 0	4 EOT 4 4	24 DC4 14 20	44 $ 24 36	64 4 34 52	104 D 44 68	124 T 54 84	144 d 64 100	164 t 74 116
0 1 0 1	5 ENQ 5 5	25 NAK 15 21	45 % 25 37	65 5 35 53	105 E 45 69	125 U 55 85	145 e 65 101	165 u 75 117
0 1 1 0	6 ACK 6 6	26 SYN 16 22	46 & 26 38	66 6 36 54	106 F 46 70	126 V 56 86	146 f 66 102	166 v 76 118
0 1 1 1	7 BEL 7 7	27 ETB 17 23	47 ' 27 39	67 7 37 55	107 G 47 71	127 W 57 87	147 g 67 103	167 w 77 119
1 0 0 0	10 BS 8 8	30 CAN 18 24	50 (28 40	70 8 38 56	110 H 48 72	130 X 58 88	150 h 68 104	170 x 78 120
1 0 0 1	11 HT 9 9	31 EM 19 25	51) 29 41	71 9 39 57	111 I 49 73	131 Y 59 89	151 i 69 105	171 y 79 121
1 0 1 0	12 LF A 10	32 SUB 1A 26	52 * 2A 42	72 : 3A 58	112 J 4A 74	132 Z 5A 90	152 j 6A 106	172 z 7A 122
1 0 1 1	13 VT B 11	33 ESC 1B 27	53 + 2B 43	73 ; 3B 59	113 K 4B 75	133 [5B 91	153 k 6B 107	173 { 7B 123
1 1 0 0	14 FF C 12	34 FS 1C 28	54 , 2C 44	74 < 3C 60	114 L 4C 76	134 \ 5C 92	154 l 6C 108	174 | 7C 124
1 1 0 1	15 CR D 13	35 GS 1D 29	55 - 2D 45	75 = 3D 61	115 M 4D 77	135] 5D 93	155 m 6D 109	175 } 7D 125
1 1 1 0	16 SO E 14	36 RS 1E 30	56 . 2E 46	76 > 3E 62	116 N 4E 78	136 ^ 5E 94	156 n 6E 110	176 ~ 7E 126
1 1 1 1	17 SI F 15	37 US 1F 31	57 / 2F 47	77 ? 3F 63	117 O 4F 79	137 _ 5F 95	157 o 6F 111	177 RUBOUT (DEL) 7F 127

LEGEND:

octal 25 / hex 15 / NAK / 21 decimal — ASCII character

NUL	– NULL	DLE	– DATA LINK ESCAPE
SOH	– START OF HEADING	DC	– DEVICE CONTROL
STX	– START OF TEXT	NAK	– NEGATIVE ACKNOWLEDGE
ETX	– END OF TEXT	SYN	– SYNCHRONOUS IDLE
EOT	– END OF TRANSMISSION	ETB	– END OF TRANSMISSION BLOCK
ENQ	– ENQUIRY	CAN	– CANCEL
ACK	– ACKNOWLEDGE	EM	– END OF MEDIUM
BEL	– BELL	SUB	– SUBSTITUTE
BS	– BACKSPACE	ESC	– ESCAPE
HT	– HORIZONTAL TABULATION	FS	– FILE SEPARATOR
LF	– LINE FEED	GS	– GROUP SEPARATOR
VT	– VERTICAL TABULATION	RS	– RECORD SEPARATOR
FF	– FORM FEED	US	– UNIT SEPARATOR
CR	– CARRIAGE RETURN	SP	– SPACE (BLANK)
SO	– SHIFT OUT	DEL	– DELETE
SI	– SHIFT IN		

GBEPS–32561–O

Table 1. ASCII Character Set

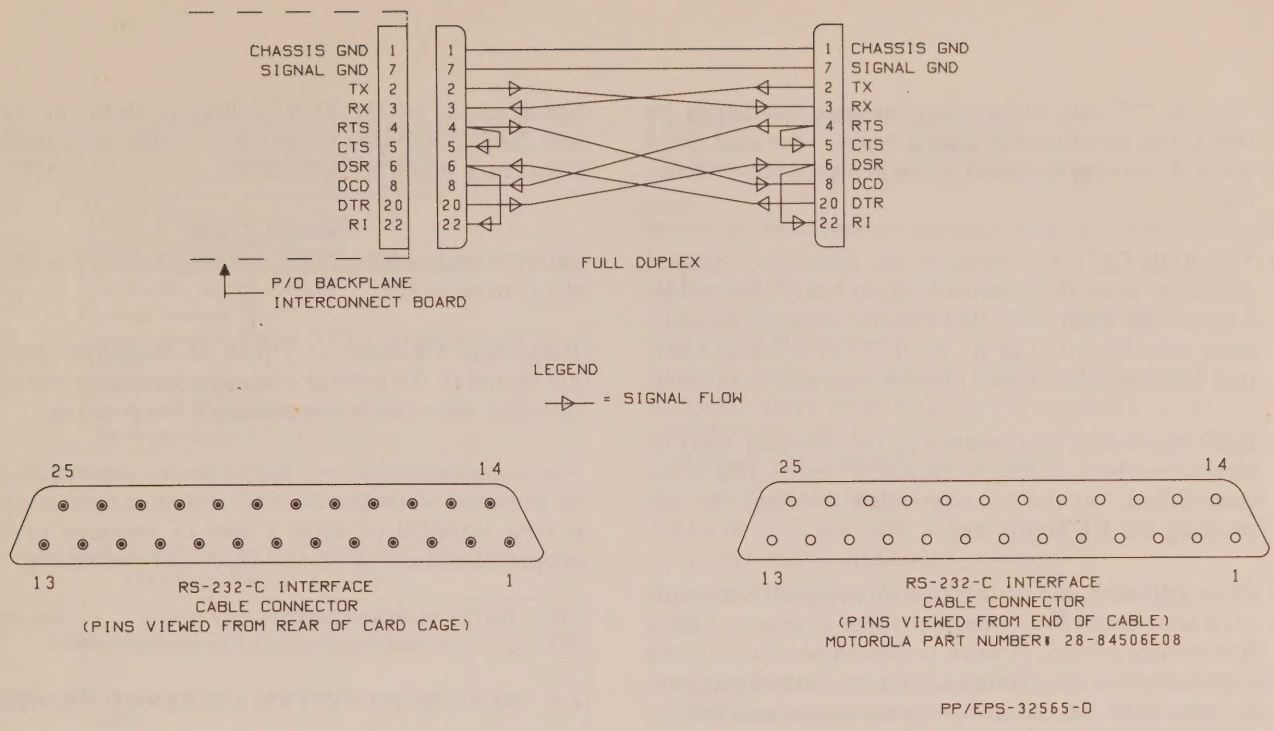

Figure 2. Null Modem Cable

communicate at the rate of 300 baud, no adjustments to the interconnect terminal are required. This is the recommended configuration for connecting the system manager's terminal to the central interconnect terminal (CIT).

If a baud rate other than 300 is desired, it can be jumper-selected on the master control (MCB) board module located in the central interconnect terminal card cage. For the following discussion, refer to the Master Control Board instruction section in instruction manual 68P81063E20.

Turn off the central interconnect terminal card cage power and remove the MCB board module from the card cage. Three jumpers are located in the upper left-hand corner of the MCB board. Move jumper JU3, in the rightmost column (labeled ADDRESS 8104-8105 on the MCB board), to the desired baud rate position.

Move only jumper JU3 (for ADDRESS 8104). Jumpers JU4 and JU5 (for ADDRESSes 8102 and 8100, respectively) should not be moved. Be sure that the selected baud rate is identical to that of the system manager's terminal (as well as to that of the modem, if a modem is used).

2.3.6 T5004 Central Controller Adjustments

When an RS-232-C terminal is locally connected by plugging it into the CSC RS-232-C connector (Figure 1B) or is remotely linked via modems, and is set to communicate at the rate of 300 baud, no adjustments to the central controller are required. This is the recommended configuration for connecting the system manager's terminal to the trunked central controller.

If a baud rate other than 300 is desired, it can be jumper-selected on the central site controller (CSC) board module located in the trunked central controller card cage. For the following discussion, refer to the Central Site Controller Board instruction section in instruction manual 68P81047E50.

Turn off the central controller card cage power and remove the CSC board module from the card cage. Three jumpers are located in the upper left-hand corner of the CSC board. Move jumper JU3, in the rightmost column (labeled ADDRESS 8104-8105 on the CSC board), to the desired baud rate position.

Move only jumper JU3 (for ADDRESS 8104). Jumpers JU4 and JU5 (for ADDRESSes 8102 and 8100, respectively) should not be moved. Be sure that the selected baud rate is identical to that of the system manager's terminal (as well as to that of the modem, if a modem is used).

2.4 USER NOTES

NOTE

All input data entered by the operator is underlined in the text to distinguish between data entered by the operator and prompt messages provided by the system. Quotation marks are not part of the instructions or prompt messages.

- ">" or "?" are the prompt message characters by which the program requests a valid command word entry (from the operator) to begin a program subroutine.

- The RUB OUT key removes the previously entered character from the terminal's input buffer and prints a backward slash "\", to indicate the previous character was deleted. The RUB OUT key is used to correct operator entry errors, before operator data entry.

- Each action and/or response by the operator *must* be terminated by a carriage return (CR) entry. This is accomplished, on the recommended terminal, by depressing the RETURN key.

- Once activated, the system control program automatically terminates if no operator input is detected for a five-minute period. If work is then to be resumed, the operator must reactivate the system control program by reentry of the control program access password.

- To terminate the system control program, the operator must first terminate any subroutine presently accessed.

- Whenever the system control program requests a response to the question — CORRECT? (Y or N) —, or whenever a — (Y or N) — response is requested; the operator MUST enter N RETURN or NO RETURN for no, and Y RETURN or YES RETURN for yes.

2.5 SYSTEM MANAGER TERMINAL ENHANCEMENTS

All Models

Recent System User — The maximum number of assignments to the high priority queue as determined by the recent user algorithm can be changed per system requirements. The default factory setting is 2. See the PARM command for additional details (optional).

Models T4051 & T4052

Interconnect — The SERV, BILL, AUTH and TELL command families are added to the command list.

Diagnostic Messages — Up to 25 diagnostic messages are stored in the CIT whenever the system manager terminal is not available for printing.

System Initialization — The following commands are to be executed when the CIT system is first installed or after a loss of memory to insure proper operation of interconnect call processing.

TIME/DATE— Initialize time and date records
BILL — Initialize airtime and TELCO charge parameters
AUTH — Initialize interconnect authorization tables
TELL — Initialize CIT hardware specifications
SERV — Initialize shared service parameter values

Specification of the FLAT billing method for Airtime and TELCO charge calculation results in a minimum data entry input being required.

Model T5004

Interconnect — The SERV command family is added to the command list.

Diagnostic Messages — Up to 25 diagnostic messages are stored in the central controller whenever the system manager terminal is not available for printing.

System Initialization — The following commands are to be executed when the trunked system central controller is first installed or after a loss of memory to insure proper operation of interconnect call processing.

TIME/DATE— Initialize time and date records
SERV — Initialize shared service parameter values

2.6 ACCESS TO SYSTEM CONTROL PROGRAM

Access to the system control program is password protected. Therefore, the operator is denied access to the command mode of the system control program until a predetermined password is entered. The password is not echoed (printed) by the terminal for security reasons.

NOTE

The specific system access password for any particular system can be obtained from the Channel Logging Form, packed with the central controller card cage. The password format is SYSTXXXX, where XXXX is the Motorola assigned system number such as 0509.

When the password is always entered, it is always followed by depressing the RETURN key. If the password is incorrectly entered (or an invalid password is attempted), the following prompt message will be printed:

INVALID PASSWORD

The operator should re-enter the correct password. When the password is properly entered, the following prompt message will be printed:

ON AT 8:30:15 MON 5/23/83
GRD>

The operator then enters any one of the subroutine entry command words listed in Table 2 or the subcommands listed in Table 3.

3. COMMAND FUNCTIONS AND RESPONSES

The function of each command word and the valid response to it are presented below.

Table 2. Subroutine Entry Command Words

Command	Subroutine Description
DATE	Query and/or Change Date and Time
TIME	Query and/or Change Time Only
CHAN	Channel Controller
PARM	System Time-Out Parameters (Optional)
SUBS	Subscriber Access Control
TEST	Initiate System Test
SERV	Interconnected Shared Service Parameters and Statistics
HELP	List of Commands
BYE	Terminate GUARDIAN Program
EXIT	Terminate GUARDIAN Program

NOTE: The SGOL or LOGS commands are not available.

Centralized Interconnect Terminal Related (Models T4051 & T4052)

Command	Subroutine Description
BILL	Initialize, Query, and/or Change Billing Parameters
AUTH	Initialize, Query, and/or Change Authorization Tables
TELL	Initialize, Query, and/or Change CIT Specifications

Table 3. Subcommand Table

Command	Subcommand
	All Models
DATE	
TIME	
CHAN	E(ENABLE), D(DISABLE), S(STATUS), QUIT
PARM	CARR, FADE, TRNK, MALF, RECENT, LIST, QUIT
SUBS	ACT, DEA, ENA, DIS, CLEAR, SET, LIST, EDIT, STAT, SAVE, LOAD, VERF, REW, PASS, OPT, QUIT
SERV	SET, LIST, ENABLE, DISABLE, STATS — (INST, TODAY, YESTERDAY), QUIT
HELP	
BYE	
TEST	
	Model T4051 & T4052
BILL	INIT, LAIR, LTEL, LEXC, MAIR, MTEL, MEXC, AEXC, DEXC, SAIR, STEL, SLNG, RSET, QUIT
AUTH	EDIT, ADD, DEL, LIST, PDIGIT, STATUS, RESET, QUIT
TELL	E(ENABLE), D(DISABLE), S(STATUS), P(PHONE LINE), R(TRIB SPEC.), QUIT
EXIT	

3.1 DATE COMMAND

The DATE command allows the operator to query and/or modify the date and time of the system clock for real-time event testing, alarm reporting, and interconnect call processing. The date format is:

DOW MM/DD/YR where: DOW = day of week (MON-SUN)
MM = month (01-12)
DD = day (01-31)
YR = year (00-99)

The time format is:

HH:MM:SS where: HH = hour (00-23)
MM = minute (00-59)
SS = second (00-59)

An example of how to use the DATE command follows:

GRD > **DATE**
CURRENT DATE (DOW MM/DD/YR) IS: SUN 0/0/00
CORRECT? (Y OR N): **N**
CHANGE DATE (DOW MM/DD/YR) TO: **MON 5/21/83**
CURRENT DATE (DOW MM/DD/YR) IS: MON 5/21/83
CORRECT? (Y OR N): **Y**
CURRENT TIME (HH:MM:SS) IS: **0:24:55**
CORRECT? (Y OR N): **N**
CHANGE TIME (HH:MM:SS) TO : **9:34:15**
CURRENT TIME (HH:MM:SS) IS: **9:34:15**
CORRECT? (Y OR N): **Y**
GRD >

The date of the week specification was added to the DATE command for interconnect call processing purposes. A space is required between the day of the week and the month specifications.

3.2 TIME COMMAND

The TIME command allows the operator to query and/or modify the time set on the system clock. The time is in a 24-hour format, as shown below:

HH:MM:SS where: HH = hour (00-23)
MM = minutes (00-59)
SS = seconds (00-59)

An example of how to use the TIME command follows:

GRD > **TIME**
CURRENT TIME (HH:MM:SS) IS: 9:39:14
CORRECT? (Y OR N): **N**
CHANGE TIME (HH:MM:SS) TO: **9:34:15**
CURRENT TIME (HH:MM:SS) IS: 9:34:15
CORRECT? (Y OR N): **Y**
GRD >

3.3 CHAN COMMAND

The CHAN command family permits the operator to enable, disable, or check the current status of a particular channel. (In this text, the repeater is referred to as the channel.) A listing of the CHAN command family follows:

E — Enable a particular channel
D — Disable a particular channel
S — Status of a particular channel
Q or QUIT — Exit to GUARDIAN prompt (GRD >)

An example of the CHAN command function follows:

GRD > **CHAN**
CHAN > **S1**
STATUS, CHANNEL 1
CHANNEL USE VOICE

```
RIB STATUS ENABLED
TRUNKING MODE MESSAGE
TIB STATUS ENABLED
XMTR STATUS ENABLED
XMTR IS NOT KEYED
CHAN > D2
CHAN > E3
CHAN > Q
GRD >
```

The enable, disable, and status of a channel is accomplished as shown. A space is required between the command (E, D, or S) and the channel number.

3.4 PARM COMMAND

The optional PARM command provides the operator with the ability to modify selective system time-out periods, within prescribed values. The command function has been enhanced to include specification of the number of consecutive assignments of a fleet/subfleet to recent user queue. The parameters available for modification are:

- Carrier Time-Out Period — Determines the time period for which an assigned voice channel remains unmuted and active, receiving only carrier and no handshake connect tones. After the time-out expires, the channel assumes the disconnect phase. The timer can be activated after disconnect tone is detected by the central controller.

- Fade Time-Out Period — Determines the time period for which an assigned voice channel remains active, even though no tones or carrier are received. After the time-out expires, the channel is unassigned. Timer is activated after the central controller fails to detect disconnect tone after loss of the low speed connect tone.

- Message Trunk Time-Out Period — Determines the time period for which a voice channel remains active after receiving disconnect from the mobile (repeater dropout time). After the time-out expires, the channel is unassigned.

- Carrier Malfunction Time-Out Period — Determines how long an interfering carrier must be present on an unassigned channel before that channel is removed from system use. An entry of 254 seconds disables the time-out.

- Recent User Assignments — Defines the maximum number of consecutive assignments of a fleet/subfleet to the high priority recent user queue. This number can be adjusted to achieve an acceptable balance between message continuity and the monopolization of a channel by a large user group.

The LIST command is used to examine the various parameters. A parameter is changed by entering the command (CARR, FADE, TRNK, MALF, or RECENT) followed by a space character and the number specification.

The PARM command family is exited by entering Q or QUIT command followed by a RETURN.

Parameter	Range	Factory Set
Carrier	0-6.3 seconds	0.5 seconds
Fade	0.1-6.3 seconds	1.2 seconds
Message Trunk	0-6.3 seconds	1.0 seconds
Carrier Malfunction	1-253 seconds	50 seconds
Recent User	0-255 assignments	2 assignments

An example of how to use the PARM Command follows:

```
GRD > PARM
PARM > LIST
CARR T.O. = 0.5
FADE T.O. = 1.2
TRNK T.O. = 1.0
MALF T.O. = 50
RECENT = 2
PARM > CARR 1.0
PARM > TRNK 2.0
PARM > RECENT 5
PARM > LIST
CARR T.O. = 1.0
FADE T.O. = 1.2
TRNK T.O. = 2.0
MALF T.O. = 50
RECENT = 5
PARM > Q
GRD >
```

3.5 SUBS COMMAND — SUBSCRIBER ADDRESS CONTROL

The Subscriber Access Control (SAC) package allows the system manager to control system access by specifying capabilities for each user. It also allows the system manager to list the capabilities for any user or group of users, inquire about the status of the user records, and backup the user records and other associated data.

3.5.1 The User Records

The user data base consists mainly of two types of records, subfleet and individual. Examples 1 and 2 show individual and subfleet type records, respectively.

Each record specifies attributes for an individual or a subfleet telling how a unit may use the system. Each record is identified by a unique ID consisting of two sets of hexadecimal numbers. The first number (3 digits) is the fleet ID, the second number (2 digits) is the individual ID, or the subfleet ID (if it is directly preceded by an "S"). Example: 001 1A, 30F 2B, 405 S1, etc. Leading zeros are required for the fleet number, e.g., 001, but not for the individual/subfleet number.

Example 1. Individual

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
000	000	Y	N	N	N	N	Y	Y	Y	Y	N	5

Example 2. Subfleet

FLT	SUBFLT	ENA	5CH	PRL
#	#	0	1	12-15
000	000	Y	N	5

3.5.1.1 USER ATTRIBUTES

This is a description of the attributes that are listed in a subscriber record.

- **Enable (ENA)** — Y indicates that the individual or subfleet is allowed to use the system when the Subscriber function is active. The system uses the default records when the Subscriber function is inactive.

- **5/20 Channel (5CH)** — Specify Y (YES) for 5-channel operation if a unit or subfleet is restricted to 5 channel use. The central controller than assigns any interconnect calls from this unit to an interconnect capable channel within the 5 channel set. For purposes of a fleetwide call, if a fleet has any 5 channel units, subfleet 0 should be set for 5 channels. This directs the central controller to assign the call to one of the channels to which all the units can listen. Example: If a user has a radio that only operates on 5 channels, a 5-channel subfleet should be set up so that 20 channel radios could talk to him and still have use of all 20 channels in another subfleet.

- **Push-To-Talk ID (PTI)** — Y directs the central controller to use the PTT-ID protocol when this unit makes a subfleet call. The central controller is programmed to accomplish PTT-ID by one of two methods: non-wireline control and wireline control. This is specified when the central controller is ordered. The subscriber units must also be purchased with the appropriate wireline or non-wireline PTT-ID option. Display of PTT-ID requires purchase of a properly optioned control station or *CENTRACOM Series* console. This attribute applies across an entire fleet, i.e., all units in a fleet must be set for the same PT1 attribute.

- **A.M.A.X. (AMX)** — Y directs a remote central controller in an Automatic Multiple Area switching system to process calls from this unit as 'area-wide' calls. This attribute also applies for the entire fleet, and has no significance in a single site or simulcast system.

- **System-Wide (SYW)** — Y indicates the unit is allowed to make a system-wide call. The unit must be equipped with the system-wide call option.

- **Fleet-Wide (FLW)** — Y indicates the unit is allowed to make a fleet-wide call.

- **Subfleet-Wide (SBW)** — Y indicates the unit is allowed to make a subfleet-wide call.

- **Private Call (PVC)** — Y indicates the unit is allowed to make a private call. The unit must be equipped with one of the private call options.

> **NOTE**
> To prevent a Private Call I supervisor from making a Private Call, all units that he can call (his 'pool') must have their Private Call option disabled.

- **Interconnect (INT)** — Y indicates the unit is allowed to make a telephone interconnect call. The unit must be capable of making an interconnect call and must be on the authorization list (paragraph 3.8) if it is active.

- **Dynamic Regrouping (DRG)** — Y indicates that one unit is allowed to dynamically regroup a second unit. Both units must be equipped with this option.

- **Priority Level (PRL)** — Priority level (2-5) to be used in assigning system resources to the unit. In the case where the unit and subfleet have different priorities, the central controller will use the higher priority (lower number). Priority does not apply to interconnect calls.

All the options have numbers assigned to them so that they can be used in the LIST and EDIT commands (Priorities add 10 to get the associated option number, e.g., priority 2 = option number 12). These numbers are printed along with the option abbreviations in the option record header as shown in Example 3. If option numbers are to be specified, the command and ID field are followed by a semicolon(;), then the option numbers which are separated by commas. This option number field makes a workspace record, where a number repre-

Example 3.

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
			Y			N				Y		4

sents a Y, unless it is preceded by a minus sign in which case it represents an N. If a number is not specified, its space is left blank. Example: The ID/option field 001 0; 1, -4, 8, 14 corresponds to Example 3.

Use of the option field is described in the sections for LIST and EDIT. If a 'D' is specified in the option field, e.g., 001 0; D, then the workspace record is filled with the default record, described next. Each position in the workspace may only be specified once, meaning that each number 0-9 may only appear once and only one number representing priority may appear in the option field.

3.5.1.2 THE DEFAULT RECORDS

If the data for a particular unit is lost, the system will first try to correct the data. If that is not possible, then the system will replace the data with the appropriate default record. These records, one for individuals and one for subfleets, have the same format as the records shown in paragraph 3.5.1, and can be operated on by specifying "DEF" or "DEF S" instead of a unit or subfleet ID. This allows the system manager to specify what grade of service a user will receive if his record is lost. It also allows the default records to be modified so they can be used with certain subscriber commands (see command descriptions, paragraph 3.5.4).

IMPORTANT

When the system manager is finished working with the default records, they should be set so that an acceptable level of service is provided for any user whose record may be lost.

If the default records are lost, then the system replaces them with default records stored in the central controller code plug. The code plug default records are determined by the subscriber option package which has been purchased and are programmed in the factory.

3.5.2 Subscriber Access Control (SAC) for *Privacy Plus* Central Controllers and T1958 with 6809 CSC Boards

When a new system or software upgrade is ordered, a SAC option number is specified which determines what user attributes the system manager can control. The options and default packages are described below.

3.5.2.1 STANDARD FEATURES FOR T5004 *PRIVACY PLUS* CENTRAL CONTROLLERS

This is the package provided if no options are specified. It allows designation of 1) 5-channel fleets, subfleets, and individuals; 2) individuals allowed to make system-wide calls; 3) designation of fleets that are to use the push-to-talk ID protocol. The ACTivate, DEActivate, ENAble and DISable commands are not available with this package. All valid IDs are always active and enabled.

3.5.2.2 NEGATIVE SUBSCRIBER (NEGS) — D411

This option provides negative subscriber for *Privacy Plus* systems. This option is intended as a replacement for the D329 Negs option. It allows 1) designation of 5-channel fleets, subfleets, and individuals; 2) designation of individuals allowed to make system-wide calls; 3) enabling/disabling entire fleets; and 4) designation of fleets that are to use the push-to-talk ID protocol. The ACTivate and DEActivate commands are not available with this package. All valid IDs are active and initially enabled. By use of the DISable command up to 16 fleets may be changed to active and disabled.

3.5.2.3 *PRIVACY PLUS* SUBSCRIBER ACCESS CONTROL — D412

This option contains all the basic functions that are required in the *Privacy Plus* Central Controller. It allows 1) enabling/disabling fleets, subfleets, and individuals; 2) designation of 5-channel fleets, subfleets and individuals; 3) designation of fleets that are to use the push-to-talk ID protocol; and 4) designation of individuals and fleets allowed to make the following call types: system wide, fleet wide, subfleet wide, private call and interconnect. All valid IDs are initially set to inactive and the subscriber function is turned off. The default record is set so that fleetwide, subfleet, interconnect, and private calls are enabled.

3.5.3 Subscriber Access Control (SAC) for T5076 *Smartnet* Central Controller

When a new system or software upgrade is ordered, a SAC option number is specified which determines what user attributes the system manager can control. The options and default packages are described below.

3.5.3.1 STANDARD FEATURES FOR THE T5076 *SMARTNET* CENTRAL CONTROLLER

This is the package provided if no options are specified. It allows designation of 1) 5-channel fleets, subfleets, and individuals; 2) individuals allowed to make system-

wide calls; 3) priority assignments for fleets, subfleets and individuals; and 4) designation of fleets that are to use the push-to-talk ID protocol. The ACTivate, DEActivate, ENAble and DISable command are not available with this package. All valid IDs are always active and enabled.

3.5.3.2 NEGATIVE SUBSCRIBER (NEGS) — D411

This option provides negative subscriber for *Smartnet* systems. It allows 1) designation of 5-channel fleets, subfleets, and individuals; 2) designation of individuals allowed to make system-wide calls; 3) enabling/disabling entire fleets; 4) designation of fleets that are to use the push-to-talk ID protocol; and 5) priority assignments for fleets, subfleets, and individuals. The ACTivate and DEActivate commands are not available with this package. All valid IDs are active and initially enabled. By use of the DISable command up to 16 fleets may be changed to active and disabled.

3.5.3.3 *SMARTNET* SUBSCRIBER ACCESS CONTROL — D413

This option controls all of the functions that are available in the *Smartnet* Central Controller. It allows 1) enabling/disabling fleets, subfleets, and individuals; 2) designation of 5-channel fleets, subfleets, and individuals; 3) designation of fleets that are to use the push-to-talk ID protocol; 4) designation of individuals and fleets allowed to make the following call types: system-wide, fleet wide, subfleet wide, private call and interconnect; 5) priority assignments for fleets, subfleets, and individuals; 6) control of what units are allowed to issue dynamic regrouping commands; and 7) designation of fleets to be given AMAX (automatic multiple switching) coverage. All valid IDs are initially set to ACTIVE and the subscriber function is turned off. The default record is set so that fleetwide, subfleet, interconnect, and private calls are enabled and set to priority five; AMAX coverage, PTT-ID, systemwide call, and dynamic regrouping are set to inactive.

3.5.4 Subscriber Commands

3.5.4.1 Password (PASS) — Any time the system manager enters the SUBS command, a password is requested. Then, whenever the system manager is within the SUBS command, he may type PASS to change the password. The password may be up to 8 characters long and each character must be an upper or lower-case letter or a number. If the password is lost from memory, or when the system is first turned on, the system prints the diagnostic message, *DIAG* CSC EE EO and the system ID becomes the new password. Example:

```
GRD > SUBS
ENTER SUBS PASSWORD (Password not echoed)
VALID COMMANDS ARE;
ACT, DEA, ENA, DIS, CLEAR, SET, LIST, EDIT, STAT, SAVE,
LOAD, VERF, REW, PASS, OPT, QUIT
SUBS > PASS
ENTER OLD PASSWORD
SYS1900
ENTER NEW PASSWORD
MOTOROLA
```

If the password cannot be remembered, it is necessary to travel to the central controller site to clear the battery backed-up RAM on the CSC board.

3.5.4.2 Options (OPT) — This command prints the abbreviations for the user attributes that the system manager is allowed to modify, along with their associated option numbers. This list is determined by which option has been purchased. Example:

SUBS	> OPT
0	ENA
1	5CH
2	PTI
3	AMX
4	SYW
5	FLW
6	SBW
7	PVC
8	INT
9	DRG
12	PRL 2
13	PRL 3
14	PRL 4
15	PRL 5

3.5.4.3 Active (ACT) — This command, which is not allowed in the standard features package or with option D411, is used to put an individual or fleet in the active records list. When a record is activated, it gets the same attributes as the default record. If an entire fleet is activated and there were no active individuals in that fleet already, then that fleet's subfleets are also enabled. The default record can be set active by specifying 'DEF' instead of a fleet/individual ID. Subfleet records may not be activated since they are always considered active. If an entire fleet is activated, the system asks 'ARE YOU SURE?' before continuing. Example:

```
SUBS > ACT 001 3
SUBS > ACT 112
ARE YOU SURE? Y
```

3.5.4.4 Deactivate (DEA) — The Deactivate command is used to remove an individual or fleet from the active records list. This means that the individual or fleet no longer shows up with the LIST command. In order to list the records again, they must be activated but this replaces whatever information was in the individual record with what is in the default record. Therefore, this command should not be used to temporarily deny service to a unit. The default record can be deactivated by specifying 'DEF'; however, it can still be listed. Subfleet records may not be deactivated since they are always considered active. Deactivate also asks 'ARE YOU SURE?' when an entire fleet is specified. Example:

SUBS > **DEA 001 3**
SUBS > **DEA 112**
ARE YOU SURE? **Y**
SUBS > **DEA DEF**

3.5.4.5 Enable (ENA) — The Enable command is used to allow a unit or units use of the system resources. The extent to which the command can be used depends upon which option is purchased. Enable is not allowed with the standard features package. D411 allows Enable only on a fleet-by-fleet basis, and D412 and D413 allow enabling of fleets, subfleets, and individuals. If Enable is used on an entire fleet, the system asks 'ARE YOU SURE?' before continuing. Example:

SUBS > **ENA 123**
ARE YOU SURE? **Y**
SUBS > **ENA 123 1**
SUBS > **ENA 123 S**
ARE YOU SURE? **Y**

3.5.4.6 Disable (DIS) — The Disable command is used to deny a unit or units use of the system resources. It is used in the same options that allow Enable. When a unit is Disabled it is not allowed to access the system, however, its attributes can still be listed. Disable also asks 'ARE YOU SURE?' if an entire fleet is specified. Systems equipped with the D411 option can delete a maximum of 16 fleets from the system. If the system manager tries to delete the 17th fleet from the system, an error message is printed and the command is aborted. Example:

SUBS > **DIS DEF**
SUBS > **DIS DEF S**
SUBS > **DIS 123**
ARE YOU SURE? **Y**
SUBS > **DIS 123 1**

3.5.4.7 List (LIST) — This command is used to display any record or related group of records. The records to be listed are specified by the input fields after the command. The first part of the record is the ID field as described in paragraph 3.5.1. If the ID field is blank, then *all* the individual records are assumed. If an entire fleet or all records are requested, then the option field can specify that only records with certain attributes be listed. Legal attributes depend on which option was purchased. Individual records may only be listed if they are active (see paragraph 3.5.4.3). The default records, both individual and subfleet, may be listed by specifying 'DEF' and 'DEF S', respectively. If a list of all records (no ID) is requested, a form feed character is sent before each fleet listing, so the terminal should be checked beforehand to make sure the top-of-form position is set. Typing control-X at any time stops a List command and returns the system to the SUBS> prompt. Example 4 shows how to use the LIST command.

3.5.4.8 Edit (EDIT) — The Edit command is used to change the attribute in any individual, subfleet, or default record. They may be changed one at a time or by entire fleets. The Edit command has two parts for its input field like List, however, there are two differences. First, a blank ID field is not allowed, and second, the option field tells what the attributes are to be changed to and therefore, must be present. Again, legal attributes depend on which option has been purchased. When the command is entered, the system prints the pattern of Y's and N's that correspond to the numbers entered. This lets the user confirm that he entered the correct numbers. If the Edit is for an entire fleet, the system asks 'ARE YOU SURE?'. After a "Y" is entered, or if this was for a single record, the system makes the specified changes. Like List, Individual records may only be Edited if they are active. Example 5 shows an EDIT command function example.

3.5.4.9 Status (STAT) — The Status command has a dual function. First, it always reports the state (active/inactive) of the subscriber function and asks if it should be changed to the other state. Second, if any records have been lost and set to default, status reports it by printing the lost IDs. Then the system manager can check the records indicated to see if they need to be updated. If a substantial number of records have been lost, then status says 'ALL SUBSCRIBER RECORDS HAVE BEEN SET TO DEFAULT'. This number may be anywhere from 32 to 255 records depending upon the sizecode map. The system manager then probably wants to reload the subscriber data from whatever backup system is used (see paragraph 3.5.4.12 through 3.5.4.14). Example 6 shows how to use the STAT command.

3.5.4.10 Clear (CLEAR) — The Clear command allows the system manager to put the entire set of user records in a known state. When the system manager types 'CLEAR', the default values in central controller code plug are copied into the default records. Then the default records are copied into all of the subscriber records. The Subscriber function is set to inactive by this command.

3.5.4.11 Set (SET) — The Set command also puts all user records to one state. When 'SET' is typed, the system copies whatever is in the default records into all the user records. The Subscriber function is set to inactive by this command.

3.5.4.12 Save (SAVE) — This command is used to save all the subscriber records and related information. The save, load, and verify routines are designed to work with a data recorder which is connected between the central controller and the system manager terminal (Figure 3), and which responds to the ASCII device control codes in the following manner: DCI — Start read, DC2 — Start write, DC3 — Stop read, DC4 — Stop write. Figure 3A shows the central controller, system manager terminal, and data recorder co-located, while Figures 3B

Example 4.

SUBS > **LIST 400 1**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
400	001	Y	N	N	N	N	Y	Y	Y	Y	N	5

SUBS > **LIST 000**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
000	000	Y	N	N	N	N	N	Y	N	Y	N	5
000	001	N	N	N	N	N	N	Y	N	Y	N	5
000	002	Y	N	N	N	N	Y	Y	N	Y	N	5
000	003	Y	N	N	N	N	N	Y	N	N	N	5
000	004	Y	N	N	N	N	N	Y	Y	Y	N	5
000	005	Y	N	N	N	N	N	Y	Y	Y	N	5
000	006	Y	N	N	N	Y	Y	Y	Y	Y	N	5
000	007	N	N	N	N	N	N	Y	N	N	N	5
000	008	Y	N	N	N	N	N	Y	N	N	N	5
000	009	Y	N	N	N	N	Y	Y	Y	Y	N	5
000	00A	Y	N	N	N	N	N	Y	N	N	N	5
000	00D	Y	N	N	N	N	N	Y	N	N	N	5
000	00E	Y	Y	N	N	N	N	Y	N	Y	N	5

SUBS > **LIST 000;7**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
000	004	Y	N	N	N	N	N	Y	Y	Y	N	5
000	005	Y	N	N	N	N	N	Y	Y	Y	N	5
000	006	Y	N	N	N	Y	Y	Y	Y	Y	N	5
000	009	Y	N	N	N	N	Y	Y	Y	Y	N	5

SUBS > **LIST 000;-8**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
000	003	Y	N	N	N	N	N	Y	N	N	N	5
000	007	N	N	N	N	N	N	Y	N	N	N	5
000	008	Y	N	N	N	N	N	Y	N	N	N	5
000	00A	Y	N	N	N	N	N	Y	N	N	N	5
000	00D	Y	N	N	N	N	N	Y	N	N	N	5

SUBS > **LIST 405 S**

FLT	SUBFLT	ENB	5CH	PRL
#	#	0	1	12-15
405	00	Y	Y	5
405	01	Y	Y	5
405	02	Y	Y	5
405	03	Y	Y	5
405	04	Y	Y	5
405	05	Y	Y	5
405	06	Y	Y	5
405	07	Y	Y	5

Example 5.

SUBS > **EDIT DEF;-8,-7**

FLT	UNT	ENB	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
									N	N		

SUBS > **EDIT 400; 5, -7, 8**

FLT	UNT	ENB	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
							Y		N	Y		

ARE YOU SURE? **Y**

SUBS > **EDIT 400 0;7**

FLT	UNT	ENB	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
									Y			

SUBS > **EDIT DEF S;1**

FLT	SUBFLT	ENB	5CH	PRL
#	#	0	1	12-15
			Y	

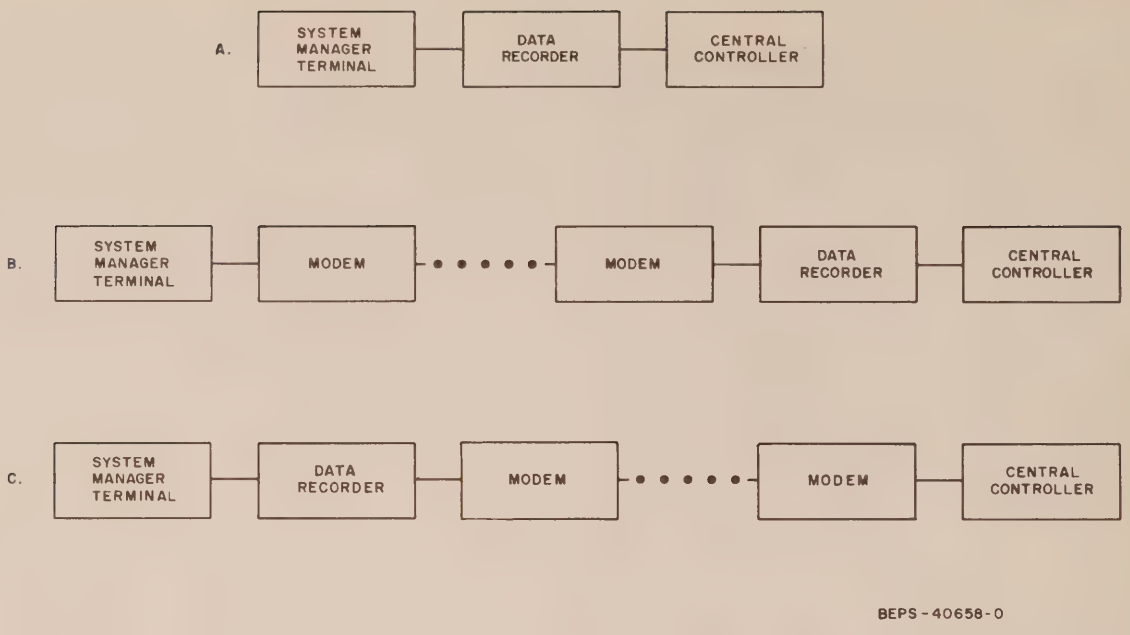

Figure 3. Optional Backup Hardware Configurations

Example 6.

```
SUBS > STAT
THESE RECORDS HAVE BEEN SET TO DEFAULT:
208    S00                208    S01
604    020                604    021
SUBSCRIBER FUNCTION IS INACTIVE
CHANGE TO ACTIVE? (Y/N) N
SUBS > STAT
SUBSCRIBER FUNCTION IS INACTIVE
CHANGE TO ACTIVE? (Y/N) N
```

and 3C show the central controller and system manager terminal at separate sites with the data recorder located at either site.

When 'SAVE' is typed, the operator is reminded to make sure the backup unit is ready to go. When a carriage return is typed in, the system will send a start write (DC2), followed by the data in the form of S-records. Each S-record consists of printable ASCII characters followed by a carriage return, a line feed, 4 nulls, and a stop read (DC3). If the data recorder passes the data along to the terminal, then the S-records will appear on the screen. When the save command is finished the system will send a stop write (DC4), the terminal shows 'SAVE DONE' and returns to the 'SUBS>' prompt. If the operator wants to stop the save at any time, a Control-X on the terminal aborts the process. Example 7 shows how to use the SAVE command.

IMPORTANT

It is a good idea to follow a save with a verify (paragraph 3.5.4.14) to ensure that the saved data is good.

3.5.4.13 Load (LOAD) — The Load command is used to load the subscriber records from the data recorder to memory. When 'LOAD' is typed, the operator is reminded to make sure that the data recorder is ready. When it is, a carriage return tells the system to start reading the data. The system sends a start read (DC1) and the data recorder reads out the first S-record, stopping when it reads the stop read (DC3). As the data is read in, the system echoes so it appears on the terminal. After the first record is processed, the system sends another start read, and the next S-record is read. This continues until the S-record indicating end-of-file is read. If a checksum error is detected in an S-record, or the operator types a Control-X, the load is aborted and the system jumps to the Status routine. A successful load returns to the 'SUBS>' prompt. The Subscriber function is set to inactive whenever a load command is used.

3.5.4.14 Verify (VERF) — The Verify command is used to compare the subscriber records in memory with what is saved by the data recorder. The operation is basically the same as for the Load command, except that the data in the S-record is compared with memory, instead of stored in memory. If the data is not the same (a checksum error is detected in the S-record) or if a Control-X is typed, the operation aborts and the 'SUBS>' prompt is printed.

Example 7.

```
SUBS> SAVE
HIT RETURN WHEN BACKUP UNIT IS READY

S0060000000100F8
S124000000C579C579C579C579C579C579C579C579C579C579C579C579C579C579C579FB
S124000020C579C579C579C579C579C579C579C579C579C579C579C579C579C579C579DB
S124000040C579C579C579C579C579C579C579C579C579C579C579C579C579C579C579BB
|
|
|
to end of save.
```

3.5.4.15 Rewind (REW) — The Rewind command simply sends a Control-Z to the data recorder. Control-Z is the code used by some recorders to do a remote control rewind.

3.5.4.16 Quit (Q or QUIT) — The Quit command is used to exit Subscriber and return to the Guardian prompt 'GRD>'.

3.5.5 Subscriber Record Error Detection and Correction

Within the subscriber software package are routines designed to detect errors in the subscriber data base, and if possible ,correct them. If there is a one-bit error within an 8-byte block of data, then the system corrects it and displays the diagnostic messages:

```
*DIAG* CSC EE FD
*DIAG* CSC OO XX
```

Where XX is a hexadecimal number representing the corrected byte. The bit which is zero in that byte is the bit position which was corrected. If the system is consistently correcting the same bit position, it is a good indication that the dynamic RAM chip for that bit is defective.

If more than one bit in an 8-byte block is in error, then the block is not correctable. All eight bytes are set to the values in the default record, and are marked as lost. The system also sends one of the following three diagnostic messages,

```
*DIAG* CSC EE FA
*DIAG* CSC EE FB
*DIAG* CSC EE FC
```

meaning that some data was lost. The operator should then use the Status command to see what records were lost so they can be corrected. The system keeps a count of lost records and if more than 255 records have been lost, sends the message,

```
*DIAG* CSC EE FE
```

meaning that all records have been lost (or at least it is likely). In this case, the best thing to do is to reload the records from the optional backup device. The last record count is cleared whenever the Status command is run.

If the CSC board loses power for an extended period of time, all data is lost and the error correcting routine sends the corresponding diagnostic message. However, there is a small chance that the error correcting routine will not correct a block of memory, thinking it is already correct. ***For this reason it is best to do a 'CLEAR' or 'SET' whenever an 'all records lost' message is received.***

3.5.6 Subscriber Error Messages

The following messages are displayed to the operator when an error is detected in the information being given to the system.

- **INVALID PASSWORD** — Password entered does not equal the old password, or is not a valid new password.
- **STRIKE THREE!** — Printed after third consecutive invalid password.
- **RECORD NOT ACTIVE** — A command (list, enable, etc.) was tried on an inactive record, or on a fleet with no active records.
- **RECORD ALREADY ACTIVE** — The active command was tried on an active record.
- **NO MATCHING RECORDS** — List could not find any records that matched the specified option list. If a single ID was specified, then it was not active.
- **INVALID FLEET, INVALID SUBFLEET, INVALID INDIVIDUAL** — The indicated portion of the ID field was defective.
- **BAD INPUT** — A good ID field was found initially but was followed by bad data.
- **OPTIONS NOT ALLOWED** — ID field was followed by a semicolon in a command where options are not allowed.

- **NUMBER OUT OF RANGE** — Specified option number is outside legal range (0-10, 12-15).

- **INVALID OPTION** — An option was specified that was not included with the purchased option package.

- **OPTIONS ONLY ALLOWED ONCE** — An option number was specified more than once in an option field.

- **PRIORITY ONLY ALLOWED ONCE** — More than one priority number (12-15) was specified in an option field.

- **CHECKSUM ERROR** — A checksum error was detected in the subscriber records. The requested operation was aborted and the error correcting routine was run.

- **BACKUP ERROR AT XXXXXX** — An error was found in the S-record that was just read (first address is XXXXXX).

- **SAVE DONE. ERRORS OCCURRED** — The error correcting routine was run at least once while a save was in progress, and the system jumps to the status routine. The data just saved should be verified to ensure it is correct.

- **BACKUP VERSION DIFFERENT. PROCEEDING** — Current backup version number does not equal version number of data being loaded, i.e., the program has been upgraded. If a translation routine is present, the Load/Verify continues. Otherwise, it aborts.

- **16 FLEETS ALREADY DISABLED, COMMAND IGNORED** — An attempt was made to disable more than 16 fleets than the D411 option allows.

3.5.7 Using Subscriber

There are two basic ways that options D412 and D413 can be used to control system access. The first way is to activate and enable all units on the system and then deny service to selected units by disabling them. Disabling rather than deactivating a unit leaves it in the subscriber list so it may be re-enabled without having to change its attributes. This method is similar to the 'Negative Subscriber' (NEGS) D411 option. The other method is to activate and enable only those units that are allowed service. This is known as a 'positive subscriber' system.

Examples 8 and 9 are examples of setting up the Subscriber data base for 'positive' and 'negative' Subscriber systems that have D412 or D413. The actual sequence varies depending on the system requirements.

In either case, it should be remembered that the default record determines:

1) what kind of service a unit receives if its record is lost, and

2) what level of service everyone receives if subscriber is deactivated.

Therefore, whenever the default record is modified, the operator should be sure that it is left with an acceptable level of service.

3.6 SERV COMMAND — INTERCONNECT SHARED SERVICE ALGORITHM

The trunked system central controller can process MRTI (Microprocessor Radio-Telephone Interconnect) calls. Land-to-mobile or mobile-to-land calls placed via a MRTI *Consolette* base station are treated as interconnected calls by the shared service algorithm.

The interconnect shared service command family provides the operator with those commands necessary to query and/or modify parameters that affect operation of the shared service algorithm. The interconnect parameter limits can be adjusted to meet the demands of traffic based upon time of day as well as the system owner's preference for grade of service of dispatch versus interconnect call traffic. The parameters are as follows:

Target Average Dispatch Busy Delay
Target Average Interconnect Busy Delay
Repeaters Reserved For Dispatch Calls (yes/no)
Minimum Number of Repeaters Usable for Interconnect
Maximum Interconnect Time-out
Minimum Interconnect Time-out

A basic understanding of the operation of the shared service algorithm is helpful in selecting parameter values from a preset factory programmed table (see Table 4).

3.6.1 Update Interval

Every 15 minutes the shared service algorithm updates the interconnect call time-out length and the maximum number of simultaneous interconnect calls allowed. The parameter update is based upon the average access delay for dispatch and interconnect calls and the erlang load of dispatch traffic.

3.6.2 Adjustment of Simultaneous Interconnect Calls

The number of simultaneous interconnect calls allowed is adjusted in two stages.

First Stage — A calculation of the dispatch erlangs used during the previous 15 minute interval *reserves* a specific number of repeaters for dispatch only use for the next interval. No repeaters are reserved, however, if the shared service parameter table indicates "0" in the Repeaters Reserved for Dispatch entry.

Example 8. Positive Examples

GRD > **SUBS**
ENTER SUBS PASSWORD
VALID COMMANDS ARE:
ACT, DEA, ENA, DIS, CLEAR, SET, LIST, EDIT
STAT, SAVE, LOAD, VERF, REW, PASS, OPT, QUIT

SUBS > **CLEAR**
ARE YOU SURE? **Y**
RECORDS CLEARED AND SUBSCRIBER OFF

SUBS > **LIST DEF**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
		Y	N	N	N	N	Y	Y	Y	Y	N	5

SUBS > **EDIT DEF;-7**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
									N			

SUBS > **LIST DEF**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
		Y	N	N	N	N	Y	Y	N	Y	N	5

SUBS > **LIST DEF S**

FLT	SUBFLT	ENA	5CH	PRL
#	#	0	1	12-15
		Y	N	5

SUBS > **DEA DEF**
SUBS > **SET**
ARE YOU SURE? **Y**
RECORDS SET AND SUBSCRIBER OFF

SUBS > **ACT 405**
ARE YOU SURE? **Y**

SUBS > **ACT 406 17**

SUBS > **ACT 406 20**

SUBS > **LIST 406**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
406	017	Y	N	N	N	N	Y	Y	N	Y	N	5
406	020	Y	N	N	N	N	Y	Y	N	Y	N	5

SUBS > **EDIT DEF;7,-8**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
									Y	N		

SUBS > **ACT 407**
ARE YOU SURE? **Y**

SUBS > **EDIT 407 24;1**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
			Y									

Example 8. Positive Examples (Cont'd.)

SUBS > **EDIT 407 25;1**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
			Y									

SUBS > **EDIT 407;1**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
407	024	Y	Y	N	N	N	Y	Y	Y	N	N	5
407	025	Y	Y	N	N	N	Y	Y	Y	N	N	5

SUBS > **EDIT 407 S0;1**

FLT	SUBFLT	ENA	5CH	PRL
#	#	0	1	12-15
			Y	

SUBS > **LIST 407 S**

FLT	SUBFLT	ENA	5CH	PRL
#	#	0	1	12-15
407	00	Y	Y	5
407	01	Y	N	5
407	02	Y	N	5
407	03	Y	N	5
407	04	Y	N	5
407	05	Y	N	5
407	06	Y	N	5
407	07	Y	N	5

SUBS > **EDIT 407 0;8**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
										Y		

SUBS > **LIST 407 0**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
407	000	Y	N	N	N	N	Y	Y	Y	Y	N	5

SUBS > **STAT**

SUBSCRIBER FUNCTION IS INACTIVE
CHANGE TO ACTIVE? (Y/N) > **Y**

NOTES ON POSITIVE SUBSCRIBER EXAMPLE:

CLEAR — Initialize the subscriber records before they are first entered. Do this only the first time that any records are entered.

EDIT DEF;-7 — Disable private call in the default record. The default record is used when a fleet is activated.

ACT 405 — Activate an entire fleet and give them the characteristics in the default record.

ACT 406 17 — Activate an individual.

LIST 406 — Only the activated records are listed.

EDIT DEF;7,-8 — Enable private call and disable interconnect calls for the next fleet we activate.

EDIT 407 24;1 — Mark this unit as a 5-channel unit.

LIST 407;1 — List all activated units in fleet 407 which are 5-channel units.

EDIT 407 S0;1 — Mark subfleet 0, fleet 407 as 5 channel so fleetwide calls work correctly (see paragraph 3.5.1.1).

EDIT 407 0;8 — Allow this unit to make interconnect calls.

STAT — All through activating and editing units. Turn the subscriber function on.

Example 9. Negative Examples

GRD > **SUBS**
ENTER SUBS PASSWORD
VALID COMMANDS ARE:
ACT, DEA, ENA, DIS, CLEAR, SET, LIST, EDIT
STAT, SAVE, LOAD, VERF, REW, PASS, OPT, QUIT

SUBS > **CLEAR**
ARE YOU SURE? **Y**
RECORDS CLEARED AND SUBSCRIBER OFF

SUBS > **LIST DEF**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
		Y	N	N	N	N	Y	Y	Y	Y	N	5

SUBS > **EDIT DEF;-5,-7**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
							N		N			

SUBS > **LIST DEF**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
		Y	N	N	N	N	N	Y	N	Y	N	5

SUBS > **LIST DEF S**

FLT	SUBFLT	ENA	5CH	PRL
#	#	0	1	12-15
		Y	N	5

SUBS > **ACT DEF**
SUBS > **SET**
ARE YOU SURE? **Y**
RECORDS SET AND SUBSCRIBER OFF

SUBS > **LIST 000 0**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
000	000	Y	N	N	N	N	N	Y	N	Y	N	5

SUBS > **DIS 404**
ARE YOU SURE? **Y**

SUBS > **DIS 300**
ARE YOU SURE? **Y**

SUBS > **DIS 205 8**

SUBS > **DIS 205 17**

SUBS > **EDIT 407 15:5**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
							Y					

Example 9. Negative Examples (Cont'd.)

SUBS > **LIST 407 15**

FLT	UNT	ENA	5CH	PTI	AMX	SYW	FLW	SBW	PVC	INT	DRG	PRL
#	#	0	1	2	3	4	5	6	7	8	9	12-15
407	015	Y	N	N	N	N	Y	Y	N	Y	N	5

SUBS > **STAT**

SUBSCRIBER FUNCTION IS INACTIVE
CHANGE TO ACTIVE? (Y/N) > **Y**

NOTES ON NEGATIVE SUBSCRIBER EXAMPLE:

CLEAR — Initialize the subscriber records before they are first entered. Do this only the first time that any records are entered.

EDIT DEF;-5,-7 — Set up the default record to the minimum attributes that all units should have.

ACT DEF — Activate the default record so all subscriber records will be activated by the 'SET' command.

SET — Move the default record into all subscriber records.

LIST 000 0 — All records now look like this.

DIS 404 — Disable an entire fleet (like 'NEGS').

DIS 205 8 — Disable an individual.

EDIT 407 15;5 — Allow unit 15, fleet 407 to make fleetwide calls.

STAT — All through activating and editing units. Turn the subscriber function on.

Second Stage — Comparison of the actual average dispatch access delay measured on the system during the last 15 minute interval to the target value determines whether the number of simultaneous interconnect calls allowed is increased, decreased, or left unchanged.

Shared service algorithm increases the number of interconnect calls allowed if:

The *dispatch* delay is *less than* its target value.

The number of simultaneous interconnect calls allowed is not increased to a value greater than that consistent with the number of repeaters reserved for dispatch, as determined in the first stage. If the algorithm attempts to do this, the value is set consistent with the reserved number.

Shared service algorithm decreases the number of interconnect calls allowed if:

The average *dispatch* access delay is *greater than* its target.

The number of simultaneous interconnect calls allowed is not decreased to a value less than that consistent with the minimum number of repeaters useable for interconnect. If the algorithm attempts to do this, the value is not changed, but the interconnect call time-out is decreased by 30 seconds (subject to the minimum interconnect time-out) to service more interconnect calls per unit time.

NOTE
The second stage of adjustment is not performed if the algorithm is disabled (see DISABLE Command paragraph 3.6.8).

3.6.3 Interconnect Time-Out Adjustment

In addition to the adjustments mentioned above, the Interconnect Call Time-Out is modified as follows:

Shared service algorithm *increases* the interconnect time-out by 30 seconds if the *interconnect* delay is below its target values.

Shared service algorithm *decreases* the interconnect time-out by 30 seconds if the *interconnect* delay exceeds its target value.

(The interconnect time-out is subject to maximum and minimum set values, as specified in Table 4. Shared Service Parameters.)

3.6.4 SERV Command

The shared service command format is as follows:

LIST —List shared service parameters
SET —Edit shared service parameters
ENABLE —Enable algorithm to adjust parameters within set limits
DISABLE —Disable algorithm from adjusting parameters from set limts
STATS —List system call processing statistics
Q or QUIT—Exit to GUARDIAN program

Table 4. Shared Service Parameters

TABLE ENTRY NUMBER	0	1	2	3	4	5	6	7
TARGET AVERAGE DISPATCH DELAY (SEC)	5	5	2	2	5	5	2	5
TARGET AVERAGE INTERCONNECT DELAY (SEC)	30	30	12	30	30	30	30	30
REPEATERS RESERVED FOR DISPATCH	Y	N	Y	Y	Y	Y	N	Y
MIN. # OF INTERCONNECT REPEATERS	1	1	1	1	1	1	3	0
MAX. INTERCONNECT TIME-OUT (MIN.)	8	15	10	4	5	3	25	8
MIN. INTERCONNECT TIME-OUT (MIN.)	2	4	3	2	1	.5	3	3

NOTE

Table entry number 0 is the default number programmed into the system for weekdays 6AM-6PM. Table entry 1 is the default number programmed into the system for weekends (all times) and weekdays 6PM-6AM. Entry 2 contains values for a lightly loaded system. Entries 3, 4, and 5 favor dispatch entry. Entry 6 favors interconnect. Entry 7 allows the system to shut out interconnect calls during peak dispatch periods.

The shared service command family is accessed through the SERV command. The function of these commands is shown in the following examples.

3.6.5 LIST Command

```
GRD > SERV
SERV > LIST
WEEKDAY:   1 1 1 0 0 0 0 0 0 1 1 1
WEEKEND:   1 1 1 1 1 1 1 1 1 1 1 1
SERV > Q
GRD >
```

The LIST command allows the operator to display the shared service parameter table entry that is assigned for each 2 hour period of a day be it a weekday or a weekend (see Table 4 Shared Service Parameters for additional details). The first parameter table number on the left assigns a set of parameters to the shared service algorithm for a 2 hour time period from 12 midnight to 1:59 AM. The last entry on the right is for the time period of 10PM to 11:59 PM.

3.6.6 SET Command

```
GRD > SERV
SERV > SET WEEKDAY 02 4
SERV > SET WEEKEND 23 3
SERV > LIST
WEEKDAY:   1 4 1 0 0 0 0 0 0 1 1 1
WEEKEND:   1 1 1 1 1 1 1 1 1 1 1 3
SERV > Q
GRD >
```

The SET command allows the operator to edit the parameter table entry number assigned to a 2 hour period of a day. The command format is SET WEEKDAY HH N or SET WEEKEND HH N. HH is the hour of the day and N is a parameter table entry number from 9-7. A space is required between SET, WEEKDAY or WEEKEND, HH, and N.

3.6.7 ENABLE Command

```
GRD > SERV
SERV > ENABLE
SERV > Q
GRD >
```

The ENABLE command allows the shared service algorithm to adjust the number of simultaneous interconnect calls and the maximum interconnect call length to values within the parameter set limits depending on dispatch and interconnect access delays. The system default is enabled.

3.6.8 DISABLE Command

```
GRD > SERV
SERV > DISABLE
SERV > Q
GRD >
```

The DISABLE command prohibits the shared service algorithm from adjusting any set parameters based on access delays. The maximum number of simultaneous interconnect calls for the disabled mode is equal to the total number of active repeaters minus the number of repeaters reserved for dispatch. The number of repeaters reserved for dispatch is determined by the dispatch erlang load (see Adjustment of Simultaneous Interconnect Calls, paragraph 3.6.2). The maximum interconnect call length is set to the value of the minimum interconnect time-out.

3.6.9 STATS Command

The STATS command allows the operator to obtain an output listing of system statistics pertaining to dispatch and interconnect call processing. The output is selectable for the following time periods: instantaneous (current 15 minute parameter update period), yesterday (each 15 minute period of yesterday), and today (each 15 minute period of the current day). Example 10 shows how to use the STATS command.

Example 10.

GRD > **SERV**
SERV > **STATS INST**

DATE 5/25/83 TIME	AVG DISP DELAY	AVG INTR DELAY	# SIMU INTR CALLS	INTR TIME OUT	# OF ACTIVE RPTRS	# OF DISP CALLS	# OF INTR CALLS	AVG DISP LNGTH	AVG INTR LNGTH	# OF DISP BUSY	# OF INTR BUSY
12:15:00	1.5	15.4	3	300.0	15	300	80	16.3	127.1	5	11

SERV > **STATS TODAY**

DATE 5/25/83 TIME	AVG DISP DELAY	AVG INTR DELAY	# SIMU INTR CALLS	INTR TIME OUT	# OF ACTIVE RPTRS	# OF DISP CALLS	# OF INTR CALLS	AVG DISP LNGTH	AVG INTR LNGTH	# OF DISP BUSY	# OF INTR BUSY
00:00:00	0.0	0.0	10	480.0	15	25	10	10.2	355.4	0	2
0:15:00	0.0	0.0	10	480.0	15	15	12	17.4	150.2	0	6
|											
|											
|											
12:15:00	1.5	15.4	3	300.0	15	300	80	16.3	127.1	5	11

SERV > **STATS YESTERDAY**

DATE 5/24/83 TIME	AVG DISP DELAY	AVG INTR DELAY	# SIMU INTR CALLS	INTR TIME OUT	# OF ACTIVE RPTRS	# OF DISP CALLS	# OF INTR CALLS	AVG DISP LNGTH	AVG INTR LNGTH	# OF DISP BUSY	# OF INTR BUSY
0:00:00	0.0	0.0	11	480.0	15	13	5	13.7	90.6	0	0
0:15:00	0.0	0.0	11	480.0	15	22	12	17.1	140.8	0	0
|											
|											
|											
23:30:00	0.0	0.0	9	600.0	15	7	3	18.1	130.4	0	0
23:45:00	0.0	0.0	9	600.0	15	19	2	9.7	110.6	0	0

The column headings for STATS listings are shown in Example 11.

3.7 TELL COMMAND (MODELS T4051 & T4052 ONLY)

The TELL command family permits the operator to enable, disable, or check the current status of a particular telephone repeater interface (TRIB) or a particular phone line interface (PLIB). Other TELL commands allow the specification of pulse or DTMF dialing for each phone line interface, assign the phone company answer threshold time, and allow the specification of the physical connection of a particular telephone repeater interface to a particular central channel number. A listing of the TELL command family follows:

E — Enable a particular TRIB or PLIB circuit
D — Disable a particular TRIB or PLIB circuit
S — Status of a particular TRIB or PLIB circuit
P — Dialing specification of a phone line (DTMF or pulse) and answer threshold time (0-60 seconds)
R — TRIB to central controller connection specification
Q — Exit to GUARDIAN prompt (GRD >)

An example of the TELL command function follows:

GRD > **TELL**
> **ER 1**
REPEATER INTERFACE #01 ENABLED
> **DR 1**
REPEATER INTERFACE #01 DISABLED
> **EP 1**
PHONE INTERFACE #01 ENABLED
> **DP 1**
PHONE INTERFACE #01 DISABLED
> **SR 2**
STATUS OF REPEATER INTERFACE #02 ENABLED
NOT ASSIGNED
NOT MALFUNCTIONED
MUTED

Example 11.

Date 5/25/83	Average Dispatch Delay (Sec)	Average Interconnect Delay (Sec)	# of Simultaneous Interconnect Calls (Max. Possible)	Interconnect Call Time-Out (Sec)	# of Active Repeaters	# of Dispatch Calls	# of Interconnect Calls (Sec)	Average Dispatch Call Length (Sec)	Average Interconnect Call Length	# of Dispatch Busies	# of Interconnect Busies
Time 12:15:30	1.5	15.4	3	300.0	15	300	80	16.3	127.1	5	11

```
> SP 2
STATUS OF PHONE INTERFACE #01
IN SYNC
ENABLED
NOT MALFUNCTIONED
NOT ASSIGNED
> P
PHONE #01 PULSE DIALING D
ANSWER THRESHOLD 10 15
PHONE #02 PULSE DIALING D
ANSWER THRESHOLD 5 15
PHONE #03 PULSE DIALING _
ANSWER THRESHOLD 15 Q
> P
PHONE #01 DTMF DIALING _
ANSWER THRESHOLD 15 _
PHONE #02 DTMF DIALING _
ANSWER THRESHOLD 15 _
PHONE #03 PULSE DIALING _
ANSWER THRESHOLD 15 Q
> R
CENTRAL RF CHANNEL #01 REPEATER INTERFACE #01 X
CENTRAL RF CHANNEL #02 REPEATER INTERFACE #02 X
CENTRAL RF CHANNEL #03 REPEATER INTERFACE #03 01
CENTRAL RF CHANNEL #04 REPEATER INTERFACE #04 02
CENTRAL RF CHANNEL #05 REPEATER INTERFACE #05 03
CENTRAL RF CHANNEL #06 REPEATER INTERFACE #06 Q
> R
CENTRAL RF CHANNEL #01 REPEATER INTERFACE #X _
CENTRAL RF CHANNEL #02 REPEATER INTERFACE #X _
CENTRAL RF CHANNEL #03 REPEATER INTERFACE #01 _
CENTRAL RF CHANNEL #04 REPEATER INTERFACE #02 _
CENTRAL RF CHANNEL #05 REPEATER INTERFACE #03 _
CENTRAL RF CHANNEL #06 REPEATER INTERFACE #06 Q
> Q
GRD >
```

An explanation of the listing follows:

- Central rf channel # — refers to repeater number.
- Repeater interface # — refers to TRIB number.
- Enable, disable, status — The enable, disable, and status of a phone interface circuit or a repeater interface circuit is accomplished as shown. A space is required between the command (E, D, or S), the interface designator (P or R), and the interface circuit number. The phone interface status of "in sync" or "out of sync" refers to the serial data communication link between the PLIB and the master control processor board.

NOTE

When an enable or disable is attempted, the terminal waits to return to the prompt until the command is executed and the result printed. If the operator does not want to wait for the result of the command to be printed, CNTRL X can be entered to return to the prompt.

NOTE (Cont'd.)

- Dialing specification — Outbound dialing to the TELCO office can be specified for each line as either DTMF or pulse compatible. The default specification is pulse dialing. Listing and editing of this information is as shown for the P command.
- Answer threshold — The Answer threshold is a period of time, from 0 to 60 seconds, that the TELCO duration of the call must be beyond before the call is TELCO billed by the CIT software. For example, if the threshold is set to 25 seconds and the time from the last digit of the phone number being entered and the end of the call is 15 seconds, then the call is assumed to be busy or unanswered and no TELCO changes are added to the user's record. If the time was 50 seconds instead of 15, then TELCO charges for the 50 seconds are assessed to the mobile units account (minimum billing period amount which is at least 1 minute). The system manager is free to set this threshold to a number that makes sense depending on how fast the TELCO lines work. Normally, 30 seconds is used. Properly using a non-zero threshold avoids overcharging for busy or unanswered calls.
- Repeater interface connection — The CIT sets the default connection between a telephone repeater interface circuit and a central rf channel to correspond to the TRIB placement in the MCP card cage. For example, the default connection specification for the three telephone repeater interfaces located on a TRIB in slot 1 is central RF channels 1, 2, and 3. For a TRIB located in slot 2 the connection specification is central RF channels 4, 5, 6, etc. The process of editing the connection specifications is as shown in the listing of the R command. The letter "X" should be entered for REPEATER INTERFACE # when there is no TRIB on that channel.

3.8 AUTH COMMAND (MODELS T4051 & T4052 ONLY)

The authorization command family provides the operator with those commands necessary to build and modify memory tables containing unit ID's authorized for interconnect call service. The authorization command format is as follows:

EDIT	— Edit unit record information
ADD	— Add unit to list
DEL	— Delete unit from list
LIST	— Provide current unit list
STATUS	— Authorization list status
PDIGIT	— Predigit dialing sequence
RESET	— Clear all user and billing information
QUIT	— Leave AUTH routine

An example of the authorization command function follows:

```
GRD > AUTH
> QUIT
GRD >
```

The status of the authorization list is given to the operator when leaving the authorization command family.

3.8.1 ADD Command

The ADD command is used by the operator to enter a new unit ID to the authorization memory table. An example of how to use the ADD command follows:

```
GRD > AUTH
> ADD 208 33
HALF DUPLEX? (Y or N) Y
ENTER LOCAL LIMIT LEVEL (1-4) 1
ENTER AUTHORIZATION STATUS LEVEL (1-5) 2
ENABLE 0+ DIALING? (Y OR N) Y
ENABLE 1+ DIALING? (Y OR N) Y
   LAND TO MOBILE ID IS 1000
> ADD 208 34*
   LAND TO MOBILE ID IS 1001
```

An explanation of the listing follows:

- ADD 208 33 — The fleet ID is specified with the first three digits (i.e., 208). The unit ID is specified with the second three digits (i.e., 033). (Note: not all three digits need be entered.) A space is required between ADD, the fleet ID, and the unit ID. The fleet and unit ID assigned to a radio are printed on a label that is attached to the unit.

- Half duplex — This feature applies to the individual users' radio. A typical dispatch radio is half duplex compatible.

- Local limit level — The local call limit level specifies the maximum TELCO charge credit for a unit during a billing period. A user who exceeds the assigned call limit level is not allowed to make further calls until the call limit level is increased. The actual dollar amount (0-$999.99) assigned to the four possible levels can be listed with the LTEL command. The dollar amounts were originally entered with the INIT command. The LTEL and INIT commands are part of the billing command family.

- Authorization status level — This parameter specifies the authorized TELCO exchange coverage area for that unit. The five possible levels are defined as follows:

  1. No calls are allowed (monthly fixed AIRTIME charges are assigned).
  2. Calls that are free in the local area code as well as calls to nearby area code(s) that are free.
     - 1+ dialing may need to be enabled if a 1 is required preceding the call.
     - Any type of 0+ calling is allowed if enabled.
     - 411, 911, and 800 calls are allowed.
  3. Free and "unit calls" to exchanges in the local area code or nearby area code(s) that have had exchange rate information entered into the system memory.
     - 1+ dialing may need to be enabled if a 1 is required preceding the call.
     - Any type of 0+ calling is allowed if enabled.
     - 411, 911, and 800 calls are allowed.
  4. All exchanges in the local area code as well as all exchanges in any area code(s) specified as nearby.
     - 1+ dialing may need to be enabled if a 1 is required preceding the call.
     - Any type of 0+ calling is allowed if enabled.
     - 411, 911, and 800 calls are allowed.
  5. All exchanges in all area codes.
     - 1+ dialing may need to be enabled if a 1 is required preceding the call.
     - Any type of 0+ calling is allowed if enabled.
     - 411, 911, and 800 calls are allowed.

  0+ refers to Telco credit card calls, i.e., 0-312-976-1212. The LEXC command can be used to list out the TELCO exchange rates for the system area code plus those that are in nearby area codes. The exchange rates were originally entered with the INIT command. The LEXC and INIT commands are part of the billing command family.

- Land to mobile ID — The land to mobile ID is the 4-digit extension that is dialed by the land party when calling that party's radio. The ID is automatically assigned.

- ADD 208 34* — Entering the * character after the unit ID results in a set of default parameters being assigned to the unit. The default parameters can be displayed or changed with the EDIT command.

NOTE

A land to mobile ID for a subfleet call is not saved in the authorization memory table but can be constructed from a valid land to mobile ID assigned to the fleet. The subfleet ID format is 9XXIIII. XX is the number of the subfleet desired, and IIII is the 4-digit land to mobile ID of a unit within the fleet. The airtime charges for a subfleet land to mobile call are billed to the unit ID. To prevent possible call conflicts of simultaneous subfleet and individual interconnect calls to a unit it is recommended that the unit ID of the dispatcher's *Consolette* base station be added to the authorization table. This results in the fixed TELCO and airtime charges being assigned to the ID.

When the system is first installed the authorization memory tables are blank. The default condition for such a system is that all mobile to land interconnect calls are authorized for a level 3 type of service. Land to mobile calls are not authorized. The system limits interconnect authorization to those units that reside on the authorization table after the authorization list has been activated through the STATUS command.

The CIT assigns land to mobile ID's on a sequential basis starting with ID number 1000. If the authorization table has to be reconstructed, the units must be entered in the same order as defined by the initial assignment of land to mobile ID's. It is important to maintain a list of mobile ID's and their assigned land to mobile 4-digit numbers to reconstruct the authorization table.

3.8.2 DEL Command

The DEL command is used by the operator to remove an existing unit ID from the authorization memory table. An example of how to use the DEL command follows:

```
GRD > AUTH
> DEL 208 33
DELETE FLEET #0208 UNIT #033? (Y OR N) Y
UNIT DELETED
> QUIT
ACTIVE USER LIST
GRD >
```

An explanation of the listing follows:

- DEL 208 33 — The fleet ID is specified with the first three digits (i.e., 208). The unit ID is specified with the second three digits (i.e., 033). Note: not all three digits need be entered. A space is required between DEL, the fleet ID, and the unit ID. The fleet and unit ID assigned to a radio are printed on a label that is attached to the radio.

The land to mobile ID that was assigned to the unit being deleted is assigned to the next unit added to the authorization memory table.

3.8.3 EDIT Command

The EDIT command is used by the operator to change authorization parameters that are assigned to a particular unit. An example of how to use the EDIT command follows:

```
GRD > AUTH
> EDIT 208 33
   LAND TO MOBILE ID IS 1000
1. LOCAL CALL LIMIT LEVEL 4
2. AUTHORIZATION LEVEL 4
3. DTMF SIGNALING
4. HALF DUPLEX
5. 0+ DIALING ENABLED
6. 1+ DIALING ENABLED
ENTER # OF PARAMETER TO CHANGE OR 7 TO QUIT
1
ENTER LOCAL LIMIT LEVEL (1-4) 2
ENTER # OF PARAMETER TO CHANGE OR 7 TO QUIT
7
> EDIT*
1. LOCAL CALL LIMIT LEVEL 3
2. AUTHORIZATION LEVEL 4
3. DTMF SIGNALING
4. FULL DUPLEX
ENTER # OF PARAMETER TO CHANGE OR 7 TO QUIT
1
ENTER LOCAL LIMIT LEVEL (1-4) 2
ENTER # OF PARAMETER TO CHANGE OR 7 TO QUIT
7
>
```

An explanation of the listing follows:

- EDIT 208 33 — The fleet ID is specified with the first three digits (i.e., 208). The unit ID is specified with the second three digits (i.e., 033). (Note: not all three digits need be entered.) A space is required between EDIT, the fleet ID, and the unit ID. The fleet and unit ID assigned to a radio are printed on a label that is attached to the radio.

- EDIT* — The * character specifies the default authorization parameter block. The default parameter block can be used to simplify the process of adding new users to the authorization memory table.

3.8.4 LIST Command

The LIST command is used by the operator to display the ID's of users that reside on the authorization memory table. A listing by fleet or system is possible. The unit ID is specified with the first three digits. The land to mobile ID is specified with the second four digits. An example of how to use the LIST command follows:

```
GRD > AUTH
> LIST 208
FLEET #208
033  1000
034  1001
> LIST
FLEET #208
033  1000
034  1001
FLEET #101
001  1005
009  1004
> QUIT
ACTIVE USER LIST
GRD >
```

The LIST command displays the authorization memory table for the entire system. LIST XXX (XXX = fleet ID) displays the authorization memory table for the entire fleet.

3.8.5 STATUS Command

The STATUS command is used by the operator to enable or disable the authorization process. After the system is first turned on or after a loss of memory, the authorization status defaults to an inactive state which limits the calling capability to mobile to land calls with 7-digit phone numbers. The status should not be made active until all units have been re-entered to the authorization memory preventing units that should be on the list from being locked out of the system. The STATUS command format is as follows:

```
GRD > AUTH
> STATUS
AUTHORIZATION ACTIVE
ACTIVATE AUTHORIZATION LIST? (Y OR N) Y
> QUIT
ACTIVE USER LIST
GRD >
```

The status of the authorization list is given to the operator when leaving the authorization command family.

3.8.6 PDIGIT Command

The pre-digit command allows the operator to specify a digit sequence dialed from a radio that is to be passed on to the TELCO office but is to be ignored by the CIT. An authorization check or TELCO charge calculation is not performed on the pre-digit sequence. A pre-digit sequence is required by some TELCO offices to be able to dial a toll call. An example of how to use the PDIGIT command follows:

```
GRD > AUTH
> PDIGIT
XXXXX___
XXXXX___
XXXXX___
XXXXX___
XXXXX___
> PDIGIT
XXXXX 123
XXXXX 31
XXXXX 471
XXXXX___
XXXXX__
> PDIGIT
123___
31 X
471___
XXXXX___
XXXXX 789
> PDIGIT
123___
XXXXX___
471___
XXXXX___
> Q
GRD >
```

An explanation of the listing follows:

When the system is first installed or after a loss of memory, the pre-digit memory table is blank. A blank entry is indicated by a series of X's. The memory table has capacity for up to 5 pre-digit sequences with up to 5 digits for each sequence. Entering a (CR) after a line output causes the program to advance to the next sequence without modifying the current pre-digit sequence. A pre-digit sequence is modified by entering the sequence as shown. A pre-digit sequence is deleted by entering an X as shown. This command cannot be terminated with the Q or QUIT commands until all five sequences are listed.

3.8.7 RESET Command

The RESET command causes authorization memory table and billing nearby area code exchange entries to be cleared, setting these functions to the same state as when power was first applied to the system. AUTH and BILL should then be initialized. An example of the command is as follows:

```
GRD > AUTH
> RESET
CLEAR ALL AUTHORIZATION + BILLING DATA, ARE YOU
SURE? (Y OR N) Y
AUTHORIZATION + BILLING RESET
>
```

NOTE

The RSET command can be used in conjunction with the RESET command to retrieve parts of the previously entered billing information without re-entering the billing information by using the INIT command. The RSET command, in this case, is used after the RESET command as shown in the RSET command paragraph.

3.9 BILL COMMAND (MODELS T4051 & T4052 ONLY)

The BILL command family provides the operator with commands necessary to initially enter and subsequently list and modify parameters used by the CIT to generate airtime and TELCO charges. Summary commands are provided for the purpose of listing airtime charges. TELCO charges, and long distance/toll call records for each authorized user of the system. The billing command format is as follows:

INIT — Initialize airtime and TELCO charge parameters
LAIR — List airtime charge parameters
LTEL — List TELCO charge parameters
LEXC — List exchange rate parameters
MAIR — Modify airtime charge parameters
MTEL — Modify TELCO charge parameters
MEXC — Modify exchange rate parameters
AEXC — Add additional exchanges and nearby area codes to billing parameters
DEXC — Delete exchanges and entire area codes from billing parameters
SAIR — Airtime summary charge listing

STEL — TELCO summary charge listing
SLNG — Long distance/toll call summary record listing
RSET — Enable or disable airtime and TELCO charge calculation

The billing command family is accessed through the BILL command as shown in the following examples.

GRD > **BILL**
? **INIT**
GRD > **BILL**
? **MAIR**
etc.

NOTE

An attempt to use a routine other than INIT when the system is first turned on, after a loss of memory, or in the DEFAULT mode results in the message ILLEGAL USEAGE OF PROCEDURE being output to the operator. An attempt to output charge summaries (SAIR, STEL, SLNG) before both the Authorization and Billing Defaults are cleared (status set to active state) results in the message ILLEGAL USEAGE OF PROCEDURE being output to the operator.

3.9.1 INIT Command

The INIT command is used by the operator to enter those system parameters required by the CIT to calculate charges for airtime and local calls. The command is to be executed once after the system is first turned on or after a loss of memory or after RESET command. The MAIR, MTEL, and MEXC commands are used to modify data entered with the INIT command.

Before using the INIT command the operator should choose a billing method for airtime and TELCO charge calculation. The different methods available in the CIT are identified and explained in detail through the following examples. Note: Due to the large number of data entries the INIT command sequence can be suspended at any time by entering Q instead of requested data input. Upon subsequently entering the INIT command, the operator is prompted with a message that permits the INIT program to be restarted at the suspension point.

Examples of how to use the INIT command follow. The first example (Example 12) is for a flat method of calculating airtime and TELCO charges.

An explanation of the listing follows:

- Airtime billing method — Two different types of billing methods can be specified (F = flat, V = variable). Flat billing results in a set amount per minute being charged for airtime regardless of the time of day or the day of the week. Variable billing method gives the operator the ability to specify charges based on the time of day or the day of the week. An example of the variable method is given later.

Example 12.

GRD > **BILL**
? **INIT**
ENTER THE REQUESTED AIRTIME BILLING INFORMATION.
BILLING METHOD? (F/V) **F**
BILLING START DATE? (01-28) **1**
TAX RATE? (XX.XX) **1.00**
MINIMUM FEE? (XXX.XX) **5.00**
AIRTIME RATE (X.XX)/MIN **.25**
ENTER THE REQUESTED TELCO BILLING INFORMATION
BILLING METHOD? (F/M/V) **F**
BILLING START DATE? (01-28) **15**
FIXED MONTHLY TELCO FEE, LESS TAX? (XXX.XX) **67.29**
LOCAL CALL LIMIT:LEVEL 1? (XXX.XX) **5.00**
LOCAL CALL LIMIT:LEVEL 2? (XXX.XX) **25.00**
LOCAL CALL LIMIT:LEVEL 3? (XXX.XX) **50.00**
LOCAL CALL LIMIT:LEVEL 4? (XXX.XX) **100.00**
FEDERAL TAX RATE? (X.XX) **2.50**
STATE TAX RATE? (X.XX) **5.25**
LOCAL TAX RATE? (X.XX) **3.75**
LOCAL AREA CODE? (XXX) **312**
FEDERAL TAX ON CALLS TO THIS AREA CODE? (Y/N) **N**
STATE TAX ON CALLS TO THIS AREA CODE? (Y/N) **Y**
LOCAL TAX ON CALLS TO THIS AREA CODE? (Y/N) **Y**
ENTER ALL FREE EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) **576**
EXCHANGE? (XXX) **359**
EXCHANGE? (XXX) **839**
EXCHANGE? (XXX) _____
ENTER NEARBY AREA CODES WITH FREE EXCHANGES.
(XXX)
HIT (CR) TO QUIT.
815

_____
? **Q**
GRD >

- Start date — The billing start date specifies the billing period for airtime charges. Note: the end of the month cannot be specified since this is a variable number.

- Tax rate — Tax rates in % (federal, state, plus local) that would apply to airtime charges.

- Minimum fee — Minimum airtime charge billed per user regardless of actual airtime used.

- Airtime rate — Charge per minute for interconnect type calls.

- TELCO billing method — Three different types of billing methods are available (F = flat, M = metered, or V = variable) to provide the operator with the flexibility of selecting the method that most closely matches that of the local TELCO office.

  Flat — TELCO offices that bill using a flat method charge a fixed amount per month for local call service

regardless of the number of calls made or the length of the calls.

Metered — TELCO offices bill a fixed amount per local call in addition to a basic service charge for metered service.

Variable — TELCO offices bill a variable amount per local call based on call length and exchange dialed.

- Start date — The start date for TELCO charges should coincide with the billing start date of the TELCO office.

- TELCO fee — All basic service charges assessed by the TELCO office that are to be spread among all users of the system.

- Local call limit — Up to 4 local call limit levels can be specified for the system. These levels establish a credit level for each authorized use of the system. A user who exceeds the assigned call limit level is not allowed to make further calls until the call limit level is increased.

- Tax rate — Tax rates in % to be applied to TELCO charges.

- Area code — Area code of the TELCO office that provides phone line service to the CIT terminal.

- Free exchanges — The operator must specify those exchanges that are covered by the basic TELCO service charges for the flat method of billing. Calls to exchanges not specified as free exchanges are treated as toll calls. No TELCO charges are calculated for toll calls by the CIT. A record of the number dialed and the unit ID is saved in memory to be listed out with the SLNG command. (Note: A particular nearby area code can only be entered once with the INIT command. If all the exchanges were not entered for a particular area code, the AEXC command must be used after completing the INIT command sequence.)

A second example (Example 13) of the usage of the INIT command is for variable airtime billing and metered TELCO billing.

An explanation of the listing follows:

Airtime billing method— See explanation given in the
Start date— first example (Example 12)
Tax rate— of the usage of the INIT
Minimum fee— command.

- Free minutes — Equals the number of initial airtime minutes per month per user that are not billed.

- Airtime rate — Up to six different system rates can be specified for airtime charge calculation. The rates are used by the CIT (Central Interconnect Terminal) to calculate airtime charges based upon the hour of the day in which the call was made. The default value for a rate is $.00.

- Rate choices — An airtime rate (1-6) is specified for each hour of the day for the time periods of weekdays and weekends.

TELCO billing method— See explanation given in the
Start date— first example (Example 12)
TELCO fee— of the usage of the INIT
Local call limit— command.
Tax rate—

- Metered call charges — Fixed per call charge applied to those exchanges specified as being metered.

- Free exchanges — List of all exchanges that are not billed.

- Metered exchanges — List of all exchanges that are to be billed per the specified metered rate. Exchanges that are not specified as free or metered are treated as toll calls.

NOTE

A particular nearby area code can only be entered once with the INIT command. If all the exchanges were not entered for a particular area code, the AEXC command must be used after completing the INIT command sequence.

A third example (Example 14) of the usage of the INIT command is for flat airtime billing and variable TELCO billing.

An explanation of the listing follows:

Airtime billing method— See explanation given in the
Start date— first example (Example 12)
Tax rate— of the usage of the INIT
Minimum fee— command.
Airtime rate—

Example 13.

```
GRD > BILL
? INIT
ENTER THE REQUESTED AIRTIME BILLING INFORMATION.
BILLING METHOD? (F/V) V
BILLING START DATE? (01-28) 1
TAX RATE? (XX.XX) 1.00
MINIMUM FEE? (XXX.XX) 5.00
FREE MINUTES? (XXX) 10
AIRTIME RATE 1? (X.XX)/MIN .25
AIRTIME RATE 2? (X.XX)/MIN .35
AIRTIME RATE 3? (X.XX)/MIN .50
AIRTIME RATE 4? (X.XX)/MIN 1.00
AIRTIME RATE 5? (X.XX)/MIN .10
AIRTIME RATE 6' (X.XX)/MIN .00
ENTER RATE CHOICES FOR WEEKDAY HOURS.
HOUR 0? (1-6) 6
HOUR 1? (1-6) 6
HOUR 2? (1-6) 5
HOUR 3? (1-6) 5
|          |          |
|          |          |
|          |          |
HOUR 12? (1-6) 4
HOUR 13? (1-6) 4
|          |          |
|          |          |
|          |          |
HOUR 22? (1-6) 1
HOUR 23? (1-6) 1
ENTER RATE CHOICES FOR WEEKEND HOURS
HOUR 0? (1-6) 1
HOUR 1? (1-6) 1
|          |          |
|          |          |
|          |          |
HOUR 22? (1-6) 1
HOUR 23? (1-6) 1
ENTER THE REQUESTED TELCO BILLING INFORMATION
BILLING METHOD? (F/M/V) M
BILING START DATE? (01-28) 15
FIXED MONTHLY TELCO FEE, LESS TAX? (XXX.XX) 67.29
LOCAL CALL LIMIT:LEVEL 1? (XXX.XX) 5.00
LOCAL CALL LIMIT:LEVEL 2? (XXX.XX) 25.00
LOCAL CALL LIMIT:LEVEL 3? (XXX.XX) 50.00
LOCAL CALL LIMIT:LEVEL 4? (XXX.XX) 100.00
FEDERAL TAX RATE? (X.XX) 2.50
STATE TAX RATE? (X.XX) 5.25
LOCAL TAX RATE? (X.XX) 3.75
CHARGE PER METERED CALL? (XX.XX) 45.00
LOCAL AREA CODE? (XXX) 312
FEDERAL TAX ON CALLS TO THIS AREA CODE? (Y/N) N
STATE TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
LOCAL TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
ENTER ALL FREE EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 576
EXCHANGE? (XXX) 359
EXCHANGE? (XXX) 839
EXCHANGE? _____
```

Example 13. (Cont'd.)

```
ENTER ALL METERED EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 690
EXCHANGE? (XXX) 554
|
|
|
EXCHANGE? (XXX) 857
EXCHANGE? _____
ENTER NEARBY AREA CODES WITH FREE OR METERED EXCHANGES. (XXX) HIT (CR) TO QUIT.
815
FEDERAL TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
STATE TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
LOCAL TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
ENTER ALL FREE EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 540
EXCHANGE? (XXX) 459
EXCHANGE? (XXX) _____
ENTER ALL METERED EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 653
EXCHANGE? (XXX) 728
EXCHANGE? (XXX) _____
ENTER NEARBY AREA CODES WITH FREE OR METERED EXCHANGES. (XXX)
HIT (CR) TO QUIT.

_____
? Q
GRD >
```

TELCO billing method—
Start date—
TELCO fee—
Local call limit—
Tax rate—

See explanation given in the first example (Example 12) of the usage of the INIT command.

- Unit charge — A unit is a measure of telephone service used by the TELCO office to charge for dialed local calls. The distance to the dialed exchange and the duration of the call determine the number of units charged to a call. The unit charge is the rate set by the TELCO office for this basic unit of service. (Note: the entry for unit charge is in cents.)

- Initial billing period — The initial billing period specifies the minimum duration of a call for billing purposes only. The initial talking period is set by the billing rate structure of the TELCO office. Calls lasting longer than the initial talk period are billed for overtime charges.

- Thereafter time period — The thereafter time period specifies the minimum overtime charge period in minutes for calls lasting longer than the initial billing period. The flexibility exists to specify different thereafter time periods based upon the number of units charged to the initial time period. An example table is given below.

Basic Charge	Initial Period	Thereafter Period	Overtime Charges
2, 3 Units	3 min.	2 min.	1 unit
4, 5, 6, 7 Units	3 min.	1 min.	1 unit
8, 9, 10 Units	3 min.	1 min.	2 units

- Rate for Area Code Exchanges (Exchange rates) — For each exchange between 200 and 999 the operator is required to specify the initial and the thereafter unit charges. The initial unit charge specifies the number of units charged to a call for the initial TELCO billing period. The thererafter unit charge specifies the number of units charged to a call for each thereafter time period beyond the initial billing period. Entering a carriage return (CR) for the initial unit charge of a particular exchange causes all calls to that exchange to be treated as toll calls. No TELCO charges are calculated for toll calls by the CIT. A record of the number dialed and the radio unit ID is saved in memory to be listed out with the SLNG command.

NOTE

A particular nearby area code can only be entered once with the INIT command. If all the exchanges were not entered for a particular area code the AEXC command must be used after completing the INIT command sequence.

Example 14.

```
GRD > BILL
? INIT
ENTER THE REQUESTED AIRTIME BILLING INFORMATION
BILLING METHOD? (F/V) F
BILLING START DATE? (01-28) 1
TAX RATE? (XX.XX) 1.00
MINIMUM FEE? (XXX.XX) 5.00
AIRTIME RATE? (X.XX)/MIN .25
ENTER THE REQUESTED TELCO BILLING INFORMATION
BILLING METHOD? (F/M/V) V
BILLING START DATE? (01-28) 15
FIXED MONTHLY TELCO FEE, LESS TAX? (XXX.XX) 67.29
LOCAL CALL LIMIT:LEVEL 1? (XXX.XX) 5.00
LOCAL CALL LIMIT:LEVEL 2? (XXX.XX) 25.00
LOCAL CALL LIMIT:LEVEL 3? (XXX.XX) 50.00
LOCAL CALL LIMIT:LEVEL 4? (XXX.XX) 100.00
FEDERAL TAX RATE? (X.XX) 2.50
STATE TAX RATE? (X.XX) 5.25
LOCAL TAX RATE? (X.XX) 3.75
UNIT CHARGE? (XX.XX) CENTS 5.29
INITIAL TELCO BILLING TIME PERIOD? (X) MINS 3
ENTER THEREAFTER TIME PERIOD FOR INITIAL UNIT CHARGE OF: 0 (X) MINS? 2
ENTER THEREAFTER TIME PERIOD FOR INITIAL UNIT CHARGE OF: 1 (X) MINS? 2
ENTER THEREAFTER TIME PERIOD FOR INITIAL UNIT CHARGE OF: 14 (X) MINS? 4
ENTER THEREAFTER TIME PERIOD FOR INITIAL UNIT CHARGE OF: 15 (X) MINS? 4
LOCAL AREA CODE? (XXX) 312
FEDERAL TAX ON CALLS TO THIS AREA CODE? (Y/N) N
STATE TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
LOCAL TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
ENTER THE RATES FOR THE FOLLOWING AREA CODE EXCHANGES.
HIT (CR) FOR UNKNOWN OR TOLL RATES. THE RATE WILL DEFAULT TO TOLL EXCHANGE 200.
INITIAL UNITS? (XX) 2
THEREAFTER UNITS? (XX) 1
EXCHANGE 201.
INITIAL UNITS? (XX) 5
THEREAFTER UNITS? (XX) 2
EXCHANGE 202.
INITIAL UNITS? (XX) 15
THEREAFTER UNITS? (XX) 4
  |
  |
  |
EXCHANGE 998.
INITIAL UNITS? (XX) 10
THEREAFTER UNITS? (XX) 3
EXCHANGE 999.
INITIAL UNITS? (XX) 2
THEREAFTER UNITS? (XX) 1
ENTER NEARBY AREA CODES WITH NONTOLL EXCHANGES. (XXX)
HIT (CR) TO QUIT.
815
FEDERAL TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
STATE TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
LOCAL TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
```

Example 14. (Cont'd.)

```
ENTER NONTOLL EXCHANGES AND THEIR RATES FOR THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 455
INITIAL UNITS? (XX) 12
THEREAFTER UNITS? (XX) 3
EXCHANGE? (XXX) 459
INITIAL UNITS? (XX) 11
THEREAFTER UNITS? (XX) 3
EXCHANGE? (XXX) _____
ENTER NONTOLL EXCHANGES AND THEIR RATES FOR THIS AREA CODE.
HIT (CR) TO QUIT.
_____
? Q
GRD >
```

- Billing — If the local area code uses exchanges that have a 1 or 0 as the second digit, e.g., 310-1234 or 408-1234, then set the exchange rate for exchange 300 to something other than TOLL (which is 15, 15). (A unit rate of 15,15 is a default value that specifies that the exchange is a toll exchange.) Even if exchange 300 is not used in the local area code, set exchange 300 to something like 1, 0. Doing this allows any 7-digit number to be processed, if authorized as usual, no matter if the exchange "looks like" an area code. Dialing other area codes in this case is always preceded by a 1. TELCO credit card calls can be 7 or 10 digits past the initial 0. For 7-digit 0+ calls, the interconnect unit waits 10 seconds after entry of the 7th digit and then "cuts-through" the call, connecting the mobile to the land line.

  If the local area code does not have any exchanges with a 0 or 1 in the 2nd digit position, or if 1+ dialing is not used, be sure to leave the exchange rate for exchange 300 = TOLL (15, 15). Doing this allows for the automatic identification, by the interconnect unit, of local or long distance calls.

3.9.2 LAIR Command

The LAIR command provides the operator with a list of parameters that are used by the CIT to calculate airtime charges for interconnect call types. These parameters were previously entered with the INIT command. CNTRL X suspends the output and returns control to the billing prompt.

Example 15 shows how to use the LAIR command.

An explanation of the listing follows:

- System number — 0509 is replaced with the actual number for the system.
- Method — F = flat or V = variable
- Start date — Day of the month that the billing period for airtime begins (1-28).
- Minimum fee — Basic airtime charge each user pays irrespective of actual airtime used ($0.00-$999.99).
- Free minutes — Airtime period which is covered by the minimum fee charge (0-999).
- Airtime rate — Up to 6 per minute airtime rates that range in value from $0.00 to $9.99 can be specified.
- Weekday rate numbers — For each hour of a weekday (Monday through Friday) an airtime rate from 1-6 is specified. The actual value of this rate (1-6) is specified in the airtime rate table.
- Weekend rate numbers — For each hour of a day (Saturday and Sunday) an airtime rate from 1-6 is specified in the airtime rate table.
- Airtime tax rate — Tax rate to be applied to airtime charges.

3.9.3 LTEL Command

The LTEL command provides the operator with a list of parameters that are used by the CIT to calculate TELCO charges for interconnect call types. These parameters were previously entered using the INIT command. CNTRL X suspends the output and returns control to the billing prompt.

Example 16 shows how to use the LTEL command.

An explanation of the listing follows:

- System number — 0509 is replaced with the actual number for the system.
- Method — F = flat, M = metered, or V = variable.

Example 15.

```
GRD > BILL
? LAIR
THIS IS THE AIRTIME BILLING INFORMATION FOR SYSTEM 0509.
METHOD — V
START DATE — 15
MINIMUM FEE — $5.00
FREE MINUTES — 5
AIRTIME RATE 1     .05
AIRTIME RATE 2     .10
AIRTIME RATE 3     .25
AIRTIME RATE 4     .85
AIRTIME RATE 5     1.95
AIRTIME RATE 6     .00

WEEKDAY      RATE      NUMBERS
HOUR         0         1
HOUR         1         1
HOUR         2         1
HOUR         3         1
HOUR         4         1
HOUR         5         1
HOUR         6         2
HOUR         7         2
HOUR         8         2
HOUR         9         3
HOUR         10        3
HOUR         11        4
HOUR         12        5
HOUR         13        5
HOUR         14        5
HOUR         15        5
HOUR         16        4
HOUR         17        3
HOUR         18        3
HOUR         19        2
HOUR         20        2
HOUR         21        1
HOUR         22        1
HOUR         23        1

WEEKEND      RATE      NUMBERS
HOUR         0         6
HOUR         1         6
HOUR         2         6
HOUR         3         1
HOUR         4         1
HOUR         5         1
HOUR         6         1
HOUR         7         1
HOUR         8         1
HOUR         9         1
HOUR         10        2
HOUR         11        3
HOUR         12        3
HOUR         13        3
HOUR         14        4
HOUR         15        3
HOUR         16        3
HOUR         17        3
HOUR         18        2
HOUR         19        1
HOUR         20        1
HOUR         21        6
HOUR         22        6
HOUR         23        6

AIRTIME TAX RATE — 5.00%
?
```

Example 16.

```
GRD > BILL
? LTEL
THIS IS THE TELCO BILLING INFORMATION FOR SYSTEM 0509.
METHOD — V
START DATE — 1
FIXED MONTHLY FEE $75.00
LOCAL CALL LIMIT:LEVEL 1 — $10.00
LOCAL CALL LIMIT:LEVEL 2 — $50.00
LOCAL CALL LIMIT:LEVEL 3 — $100.00
LOCAL CALL LIMIT:LEVEL 4 — $999.00
UNIT CHARGE 5.29 CENTS
FEDERAL TAX 1.00%
STATE TAX 2.00%
LOCAL TAX 3.15%
INITIAL BILLING TIME PERIOD (MIN) 3
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 0    2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 1    2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 2    2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 3    2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 4    1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 5    1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 6    1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 7    1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 8    1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 9    1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 10   1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 11   1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 12   1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 13   1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 14   1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 15   1
?
```

- Start date — Day of the month that the billing period for the TELCO charges begins (1-28).

- Fixed monthly fee — Monthly TELCO charges for basic phone line termination (0-$999.99).

- Local call limit — Up to 4 local call limit levels can be specified. Each authorized user is assigned a call limit level from 1-4. A user who exceeds the assigned call limit level will not be allowed to make further calls until the call limit level is increased (0-$999.99).

- Unit charge — TELCO charges assigned to a unit which is defined to be a measure of telephone service used in the calculation of charges for dialed local calls. Distance and the length of the call determine the number of units charged.

- Federal, State, Local tax — Tax rates to be applied to TELCO charges.

- Initial billing period — The minimum billing period in minutes used by the TELCO office to calculate charges for local calls. For example, a 1 minute local call to a TELCO office with a 3 minute minimum is billed as a 3 minute call.

- Thereafter time period — The minimum billing period in minutes for that time in excess of the initial billing period used by the TELCO office to calculate charges for local calls. The minimum billing period may vary depending on the distance of the exchange called. The multiple entry table provides the required flexibility (0-9 minutes).

3.9.4 LEXC Command

The LEXC command provides the operator with a list of TELCO exchange rates that are used by the CIT to calculate TELCO charges for local interconnect call types. These parameters were previously entered using the INIT command. CNTRL X suspends the output and returns control to the billing prompt.

Example 17 shows how to use the LEXC command.

An explanation of the listing follows:

- System number—0509 is replaced with the actual number for the system.

Example 17.

```
GRD > BILL
? LEXC

THIS IS THE EXCHANGE RATE INFORMATION FOR SYSTEM 0509.
AREA CODE — 312
FEDERAL TAX Y
STATE TAX Y
LOCAL TAX Y
LOCAL AREA CODE EXCHANGE RATES:
```

EXCH	0	1	2	3	4	5	6	7	8	9
200	03,01	02,01	03,01	06,02	01,01	00,00	02,01	03,01	10,02	15,05
210	09,03	03,01	04,02	00,00	04,01	06,02	01,00	05,01	11,03	01,00
990	01,01	03,01	09,02	10,01	12,02	02,01	04,01	01,00	00,00	00,00

```
AREA CODE—414
FEDERAL TAX Y
STATE TAX N
LOCAL TAX N
EXCHANGE RATES—
576  01,00
872  06,01
415  04,01
690  01,01
END OF RETRIEVAL
AREA CODE—815
FEDERAL TAX Y
STATE TAX Y
LOCAL TAX Y
EXCHANGE RATES—
892  03,01
668  02,01
END OF RETRIEVAL
END OF RETRIEVAL
?
```

- Area Code (i.e., 312)—Area code of the TELCO office that provides phone line service to the CIT terminal. The area code changes depending on system location.

- Federal, State, Local tax—Y-tax is to be included in the calculation of charges, N-tax is ignored. The actual tax rates can be listed with the LTEL command.

- Local exchange rates—Listing of the units for all possible TELCO exchanges from 200 to 999 for local calls. For example, the unit rate for exchange 203 is 06,02. The 06 specifies the number of units charges or the initial billing time period. The 02 specifies the number of units charged for the thereafter time periods. The unit charge, initial billing time period, and thereafter time period can be listed with the LTEL command. A unit rate of 15,15 is a default value that specifies the exchange is a toll call exchange.

- Area code (i.e., 414,815)—The exchanges listed for these area codes are treated as local calls for billing purposes by the TELCO office.

3.9.5 MAIR Command

The MAIR command provides the operator with the means to modify airtime billing parameters. These parameters were previously entered with the INIT command. For each parameter line output, the operator must enter a (CR) to leave the parameter unchanged, a data stream to modify the parameter, or a Q to exit the routine and return to the billing prompt. The changes can be verified with the LAIR command.

Example 18 shows how to use the MAIR command.

The method, start date, free minutes, airtime rate 4, hour 4, and hour 6 parameters remain unchanged. The other parameters were changed as shown per (underlined) values.

3.9.6 MTEL Command

The MTEL command provides the operator with the means to modify TELCO billing parameters. These parameters were previously entered with the INIT command. For each parameter line output the operator

Example 18.

```
GRD > BILL
? MAIR
THIS IS THE AIRTIME BILLING INFORMATION FOR SYSTEM 0509
METHOD—V ____
START DATE—1 ____
MINIMUM FEE—$7.50 8.00
FREE MINUTES—6 ____
AIRTIME RATE 1—$.25 .00
AIRTIME RATE 2—$.35 .25
AIRTIME RATE 3—$.45 .35
AIRTIME RATE 4—$.55 ____
AIRTIME RATE 5—$.75 .85
AIRTIME RATE 6—$.00 1.00
WEEKDAY RATE NUMBERS
HOUR 0 6 1
HOUR 1 6 1
HOUR 2 6 1
HOUR 3 6 2
HOUR 4 2 ____
HOUR 5 3 2
HOUR 6 2 Q
?
```

must enter a (CR) to leave the parameter unchanged, a data stream to modify the parameter, or a Q to exit the routine and return to the billing prompt. The changes can be verified with the LTEL command.

Example 19 shows how to use the MTEL command.

The method, start date, local call limit levels 1 and 2, unit charge, federal and state tax, initial billing time period, and thereafter time period for initial unit charge of 1 and 3 minutes remain unchanged. The other parameters were changed as shown per (underlined) values.

3.9.7 MEXC Command

The MEXC command provides the operator with the means to modify exchange rate billing parameters. These parameters were previously entered with the INIT command. For each parameter line output, the operator must enter a (CR) to leave the parameter unchanged, a data stream to modify the parameter, or a Q to exit the routine and return to the billing prompt. The changes can be verified with the LEXC command.

Example 20 shows how to use the MEXC command.

Example 19.

```
GRD > BILL
? MTEL
THIS IS THE TELCO BILLING INFORMATION FOR SYSTEM 0509
METHOD—V ____
START DATE—1 ____
FIXED MONTHLY FEE $44.59 53.66
LOCAL CALL LIMIT: LEVEL 1—$  8.00 ____
LOCAL CALL LIMIT: LEVEL2—$ 25.00 ____
LOCAL CALL LIMIT: LEVEL 3—$100.00 50.00
LOCAL CALL LIMIT: LEVEL4—$999.00 75.00
UNIT CHARGE 5.29 CENTS ____
FEDERAL TAX 1.00% ____
STATE TAX 2.00% ____
LOCAL TAX 3.20% 3.30
INITIAL BILLING TIME PERIOD (MIN) 3 ____
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 0 1 2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 1 2 ____
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 2 2 1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 3 2 Q
?
```

Example 20.

```
GRD > BILL
? MEXC
THIS IS THE EXCHANGE RATE INFORMATION FOR SYSTEM 0509
AREA CODE—312 ___
FEDERAL TAX Y ___
STATE TAX Y ___
LOCAL TAX Y ___
LOCAL AREA CODE EXCHANGE RATE MODIFICATIONS—
ENTER EXCHANGE TO MODIFY OR JUST HIT RETURN TO QUIT
IF PRESENT EXCHANGE RATE IS CORRECT, JUST HIT RETURN, ELSE ENTER NEW RATE
EXCHANGE? (XXX) 229
10, 01
INITIAL UNITS? (XX) 15
THEREAFTER UNITS? (XX) 2
EXCHANGE? (XXX) 229
15, 2
INITIAL UNITS? (XX) ___
THEREAFTER UNIT? (XX) ___
EXCHANGE? (XXX) ___
NEARBY AREA CODE EXCHANGE RATE MODIFICATIONS—
IF PRESENT EXCHANGE RATE IS CORRECT, JUST HIT RETURN, ELSE ENTER NEW RATE
AREA CODE—815
FEDERAL TAX Y ___
STATE TAX N ___
LOCAL TAX N ___
EXCHANGE RATES
344 00,00
INITIAL UNITS? (XX) 3
THEREAFTER UNITS? (XX) 1
385 03,01
INITIAL UNITS? (XX) ___
THEREAFTER UNITS? (XX) ___
396 03,01
INITIAL UNITS? (XX) 2
THEREAFTER UNITS? (XX) 2
472 04,02
INITIAL UNITS? (XX) Q
?
```

Each exchange to be modified in the local area code must be specified. Entering a (CR) after INITIAL UNITS? (XX) or THEREAFTER UNITS? (XX) will result in the parameter being unchanged. Entering a (CR) after an EXCHANGE? (XXX) in the local area code causes the program to advance to the nearby area code exchanges. Modification of an exchange in the nearby area code is accomplished by cycling through all the exchanges for each of the nearby area code. Entering a Q causes the routine to exit to the billing prompt.

3.9.8 AEXC Command

The AEXC command allows the operator to add additional exchanges and nearby area codes to the TELCO billing exchange tables. The INIT command was used by the operator to initially create the exchange tables. The following examples demonstrate the use of this command. The first example (Example 21) applies to a system that has been set up for a *flat* TELCO billing method.

Example 21.

```
GRD > BILL
? AEXC
ENTER AREA CODE? (XXX) 312
ENTER ALL FREE EXCHANGES WITHIN THIS AREA CODE
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 333
EXCHANGE? (XXX) 576
EXCHANGE? (XXX) ___
ENTER AREA CODE? (XXX) 815
ENTER ALL FREE EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 344
EXCHANGE? (XXX) ___
ENTER AREA CODE? (XXX) ___
? Q
GRD >
```

Free exchanges 333 and 576 were added to the 312 are code exchange list, and exchange 344 was added to the 815 list. The second example (Example 22) shows the addition of exchanges for a new area code.

Entering a (CR) after EXCHANGE? (XXX) causes the program to advance to the next step of requesting additional area codes. Entering a (CR) after ENTER AREA CODE? (XXX) causes the program to exit to the billing prompt. Entering a Q causes the program to exit to the billing prompt.

The second example (Example 22) applies to a system that has been set up for a *metered* TELCO billing method.

Example 22.

```
GRD > BILL
? AEXC
ENTER AREA CODE? (XXX) 312
ENTER ALL FREE EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 333
EXCHANGE? (XXX) 576
EXCHANGE? (XXX) ___
ENTER ALL METERED EXCHANGES WITHIN THIS AREA
CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 523
EXCHANGE? (XXX) ___
ENTER AREA CODE? (XXX) 414
FEDERAL TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
STATE TAX ON CALLS TO THIS AREA CODE? (Y/N) N
LOCAL TAX ON CALLS TO THIS AREA CODE? (Y/N) Y
ENTER ALL FREE EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 456
EXCHANGE? (XXX) ___
ENTER ALL METERED EXCHANGES WITHIN THIS AREA
CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) 690
EXCHANGE? (XXX) 657
EXCHANGE? (XXX) ___
ENTER AREA CODE? (XXX) Q
? Q
GRD >
```

Entering a new area code results in questions on taxes being asked of the operator.

The third example (Example 23) applies to a system that has been set up for a *variable* TELCO billing method.

NOTE

The maximum number of units that can be specified for initial and thereafter time periods is 15. The minimum is zero.

3.9.9 DEXC Command

The DEXC command allows the operator to delete entire area codes (excluding the local area code) or specific exchanges (excluding exchanges within the local area code table) from the billing exchange memory tables. The MEXC command is used to delete or modify exchanges for the local area code. An example of how to use the DEXC command follows:

```
GRD > BILL
? DEXC
ENTER AREA CODE? (XXX) 815
DO YOU WISH TO DELETE THIS AREA CODE? (Y/N) N
EXCHANGE? (XXX) 344
EXCHANGE? (XXX) ___
ENTER AREA CODE? (XXX) ___
?
```

Exchange 344 was deleted from area code 815 in this example. Answering Y to the question DO YOU WISH TO DELETE THIS AREA CODE? (Y/N) would have resulted in all exchanges for area code 815 being deleted. Entering a (CR) after EXCHANGE? (XXX) causes the program to advance to the next step of requesting additional area codes. Entering a (CR) after ENTER AREA CODE? (XXX) causes the program to exit to the billing prompt. Entering a Q causes the program to exit to the billing prompt.

3.9.10 SAIR Command

The SAIR command provides the operator with a listing of airtime charges for the current or previous billing periods. The operator is given the choice of specifying the listing of airtime charges for the entire system, fleet, or unit. CNTRL X suspends the output and returns control to the billing prompt of ?. Entering a Q for billing period returns control to the billing prompt.

An example of the command function follows:

```
GRD > BILL
? SAIR
BILLING PERIOD? L = LAST; T = THIS L
FLEET? XXX OR (CR) FOR ALL ___
```

AIRTIME CHARGES FROM 5-1 TO 6-1 FOR SYSTEM 0509

Fleet ID	Unit ID	Airtime Min./Sec.	Fixed Charge	Additional Charge	Tax	Total
024	123	12.11	5.00	7.54	.10	12.64
024	124	8.50	5.00	5.62	.08	10.70
024	125	13.07	5 .00	8.19	.11	13.30
	3	34.08	15.00	21.35	.29	36.64 Fleet Total
222	01A	17.24	5.00	10.76	.14	15.90
	1	17.24	5.00	10.76	.14	15.90 Fleet Total
	4	51.32	20.00	32.11	.43	52.54 System Total

```
BILLING PERIOD? L = LAST; T = THIS T
FLEET? XXX OR (CR) FOR ALL 024
UNIT? XXX OR (CR) FOR ALL
```

Example 23.

GRD > **BILL**
? **AEXC**
ENTER AREA CODE? (XXX) **312**
ENTER ALL EXCHANGES WITHIN THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) **453**
INITIAL UNITS? (XX) **3**
THEREAFTER UNITS? (XX) **4**
EXCHANGE? (XXX) ___
ENTER AREA CODE? (XXX) **414**
FEDERAL TAX ON CALLS TO THIS AREA CODE? (Y/N) **Y**
STATE TAX ON CALLS TO THIS AREA CODE? (Y/N) **N**
LOCAL TAX ON CALLS TO THIS AREA CODE? (Y/N) **Y**
ENTER NONTOLL EXCHANGES AND THEIR RATES FOR THIS AREA CODE.
HIT (CR) TO QUIT.
EXCHANGE? (XXX) **456**
INITIAL UNITS? (XX) **12**
THEREAFTER UNITS? (XX) **3**
EXCHANGE? (XXX) ___
ENTER AREA CODE? (XXX) **3**
?

AIRTIME CHARGES FROM 6-1 THRU 6-10 FOR FLEET 024 FOR SYSTEM 0509

Fleet ID	Unit ID	Airtime Min./Sec.	Fixed Charge	Additional Charge	Tax	Total
024	123	5.13	5.00	3.68	.06	8.74
024	124	2.11	5.00	1.36	.03	6.39
024	125	18.43	5.00	9.74	.16	14.90
	3	26.07	15.00	14.78	.25	30.03 Fleet Total

?

An explanation of the listing follows:

- System number—0509 is replaced with the actual number for the system.
- Billing period—L = billing period for the previous month, T = current billing period up to the current day.
- FLEET?XXX—Entering a fleet ID limits the listing to the specified fleet. A (CR) results in the entire system being listed.
- Unit?XXX—Entering a unit ID limits the listing to the specified unit. A (CR) results in the entire fleet being listed.
- Airtime—The actual airtime in minutes and seconds for interconnect call types for the billing period.
- Fixed charge—Fixed airtime charge independent of airtime used.
- Additional charge—Airtime charges that were calculated by the CIT based upon airtime used, time of day, and day of the week.

NOTE

The airtime charges fore the previous billing period are saved for an entire billing period. For example, the charges calculated for the period of 5-1 to 6-1 are saved until the date of 7-1.

3.9.11 STEL Command

The STEL command provides the operator with a listing of TELCO charges for the current or previous billing periods. The operator is given the choice of specifying the listing of TELCO charges for the entire system, fleet, or unit. CNTRL X suspends the output and returns control to the billing prompt of?. Entering a Q for billing period returns control to the billing prompt.

An example of the command function follows:

GRD > **BILL**

? **STEL**

BILLING PERIOD? L = LAST; T = THIS **L**

FLEET? XXX OR (CR) FOR ALL ___

LOCAL CALL CHARGES FROM 5-1 TO 6-1 FOR SYSTEM 0509

Fleet ID	Unit ID	Local Calls	Call Charges	Taxes St-Loc	Taxes Fed	Total Charge
024	123	50	8.10	.40	.29	8.79
024	125	36	6.26	.35	.26	6.87

Fleet ID	Unit ID	Local Calls	Call Charges	Taxes St-Loc	Taxes Fed	Total Charge
024	125	52	8.67	.41	.30	9.38
	3	138	23.03	1.16	.85	25.04 Fleet Total
222	01A	68	11.24	.72	.34	12.30
	1	68	11.24	.72	.34	12.30 Fleet Total
	4	206	34.27	1.88	1.19	37.34 System Total

BILLING PERIOD? L = LAST, T = THIS **T**

FLEET? XXX OR (CR) FOR ALL **024**

UNIT? XXX OR (CR) FOR ALL **124**

LOCAL CALL CHARGES FROM 6-1 THRU 6-10 FOR FLEET 024, UNIT 124 FOR SYSTEM 0509

Fleet ID	Unit ID	Local Calls	Call Charges	Taxes St-Loc	Taxes Fed	Charge
024	124	37	6.42	.36	.27	7.05

?

An explanation of the listing follows:

- System number—0509 is replaced with the actual number for the system.
- Billing period—L = billing period for the previous month, T = current billing period up to the current day.
- FLEET? XXX—Entering a fleet ID limits the listing to the specified fleet. A (CR) results in the entire system being listed.
- UNIT? XXX—Entering a unit ID limits the listing to the specified unit. A (CR) results in the entire fleet being listed.
- No. of local calls—Actual number of interconnect calls made during the billing period.
- Call charges—TELCO charges for local calls that were calculated by the CIT based upon length of call and exchange dialed.
- Taxes—Taxes for call charges as calculated by the CIT.

NOTE

The TELCO charges for the previous billing period are saved for an entire billing period. For example, the charges calculated for the period of 5-1 to 6-1 are saved until the date of 7-1.

3.9.12 SLNG Command

The SLNG command provides the operator with a report detailing long distance and toll calls made on the system. The programs that produce these reports have limited memory space in which to store call records. On those systems with many interconnect users, it may be necessary to run this report and clear memory more frequency than once per month. CNTRL X suspends the output and returns control to the billing prompt of ?

An example of the command function follows:

GRD > **BILL**
? **SLNG**

LONG DISTANCE CALLS FROM 6-1 THRU 7-1
FOR SYSTEM 0509

Fleet	Unit	Date	Time	Min	Number
024	123	6-07	917A	2	815-690-2478
024	123	6-21	1105P	5	815-556-4701
024	123	6-22	148P	3	419-271-5419
024	125	6-02	734A	3	309-576-5063
022	015	6-09	1050P	2	608-753-4728
022	021	6-21	1026A	4	509-447-3168

?

NOTE

If a printed phone number has the letter "B" as a digit, it means that a "*" was entered as a digit. The letter "C" represents an entry of a "#". If a phone number is printed as 815-69C-B123, then the number dialed was 815-69#-*123.

3.9.13 Call Logging Function

The system manager can choose to turn on CALL LOGGING which results in a LONG DISTANCE call record being generated for every call, whether land-to-mobile or mobile-to-land. This logging would be in addition to the normal airtime and TELCO billing records that take place. The calls can be listed and cleared from memory with the BILL SLNG command. Presently, there is room in the memory for a total of 950 call records such as logging records, long distance call records or (0+) credit card call records.

To turn on LOGGING:

GRD > **BILL**
? **LOGY**

To turn off LOGGING:

GRD > **BILL**
? **LOGN**

Only true long distance or (0+) calls will be denied if the records become full. In this case, an error message is sent to the system manager who must run the SLNG COMMAND and clear the memory.

3.9.14 Special Call Processing — PBX Command

If the interconnect system is used on a private system, such as a single company or possibly a public safety system, the system manager may elect to turn on "PBX PROCESSING". This is normally used where the telephone system that the CIT is connected to is a private PBX, where internal 4-digit numbers are normally dialed, or a public phone system where the dialing is standard, as in 7-digit local number and 10-digit toll numbers, but the TELCO billing is not required (such as in a public safety system).

When PBX processing is active, turned on by the system manager in the BILL command, authorization does not process the phone number dialed for mobile-to-land calls. In other words, the mobile unit is allowed to dial any phone number. The number dialed can be monitored in either of two ways, however. One way is to turn on logging, which generates a call record for every call, mobile-to-land or land-to-mobile. The second way is to use the MEXC command in BILL to set the exchange rate for exchange 200 to toll (15,15). Exchange rate 200 is used for each call when PBX processing is turned on. If logging is off, and the rate for exchange 200 is set to (15,15), then only mobile-to-land calls generate call records, which can be read and cleared with the SLNG command in BILL. Mobile-to-land calls are not shut off if the records become full. (The memory has room for 950 calls records.)

If the exchange rate for exchange 200 is set to free (00,00), and logging is turned on, then each call is mobile-to-land or land-to-mobile logged into the call records and the "Local Call" count in the BILL STEL summary is increased by 1 for each mobile-to-land call.

If the exchange rate for exchange 200 is set to a metered charge rate such as (01,00), then each mobile-to-land call is billed 1 unit. If logging is on, then a call record is generated too.

When PBX processing is used, the audio from the mobile is immedately "cut-through" to the phone company allowing the mobile to pass DTMF digits directly on to the PBX. The phone lines must be DTMF compatible.

Turning on PBX processing is done as follows:

```
GRD > BILL
? PBXY
```

Turning off PBX processing is done as follows:

```
GRD > BILL
? PBXN
```

3.9.15 RSET Command

The RSET command allows the operator to execute the INIT command a second time thereby eliminating all previously entered airtime and TELCO charge parameter information. This command should only be used to clear a condition in which the majority of airtime and TELCO charge parameter information is invalid. The parameters are cleared upon execution of the INIT command after the RSET command. An example of the command function follows:

```
GRD > BILL
? RSET
USE 'INIT' INPUT TO CALCULATE BILLING CHARGES?
(Y/N) N
? INIT
  |
  |
  |
ETC.
```

The RSET command can also be used after a RESET command to possibly save the airtime and TELCO charge parameters including the local area code exchange rate entries.

Example 24 shows how to use the RSET command in this way.

3.10 TEST COMMAND

All Models

The TEST command is used to activate the software Diagnostic System Test. It is identical to the manual test performed when activated by the front panel TEST pushbutton (see Figures 4A and 4B) on the Central Site Controller module. The software Diagnostic System Test includes tests on all three site controller board modules, the CSC, and RSC and the TSC.

The tests on the CSC are:

- A test of each RAM integrated circuit.
- A test of each EPROM integrated circuit, thru a checksum process (sum of bytes in each EPROM should equal a specified number).
- A test on battery powered operation.
- A system test.

The tests on the RSC are:

- A test of each RAM integrated circuit.
- A checksum test of each EPROM integrated circuit.
- An IRB check.
- A RIB check—tone detectors.

The tests on the TSC are:

- A test of each RAM integrated circuit.
- A checksum test of each EPROM integrated circuit.

Example 24.

```
GRD > AUTH
> RESET
CLEAR ALL AUTHORIZATION + BILLING DATA, ARE YOU SURE? (Y OR N) Y
AUTHORIZATION + BILLING RESET
> Q
INACTIVE USER LIST
GRD > BILL
? RSET
USE 'INIT' INPUT TO CALCULATE BILLING CHARGES (Y/N) Y
?
```

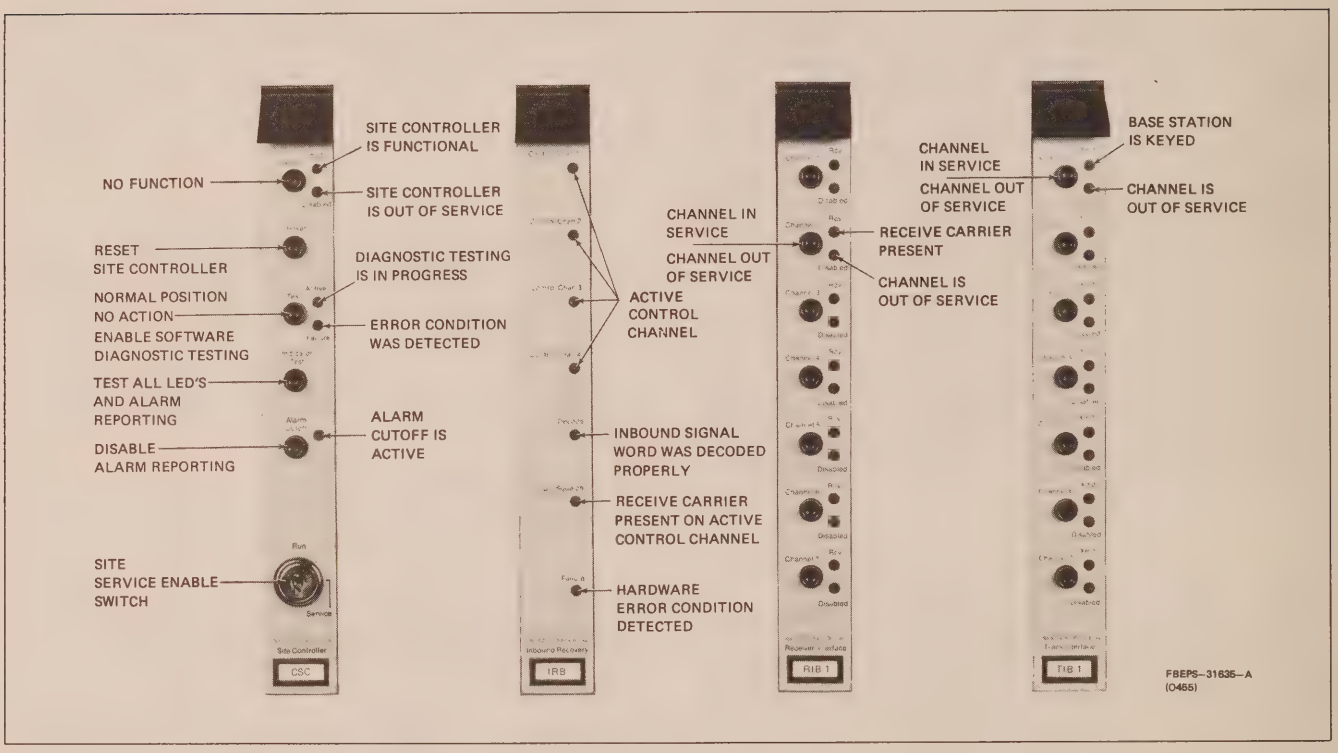

Figure 4A. Module Controls and Indicators (All Models)

- A TIB check—keys channel and checks transmitter status.

The tests on the MCB (Models T4051 & T4052 Only) are:

- A test of each RAM integrated circuit.
- A checksum test of each EPROM integrated circuit.

The tests on the PLIB are:

- A test of each RAM integrated circuit.
- A checksum test of each EPROM integrated circuit.
- A DTMF loopback test.
- A dial tone detect test.
- A TELCO line test.
- A matrix vertical test (part of matrix board).

NOTE

At the 2400 hour (12:00 Midnight) rollover time, as determined by the system realtime clock, the Diagnostic System Test is automatically activated. The actual start of the test is deferred until there is no current active voice channel communications. When all voice channels are unused, the test begins. The control channel is designed, and a complete software Di-

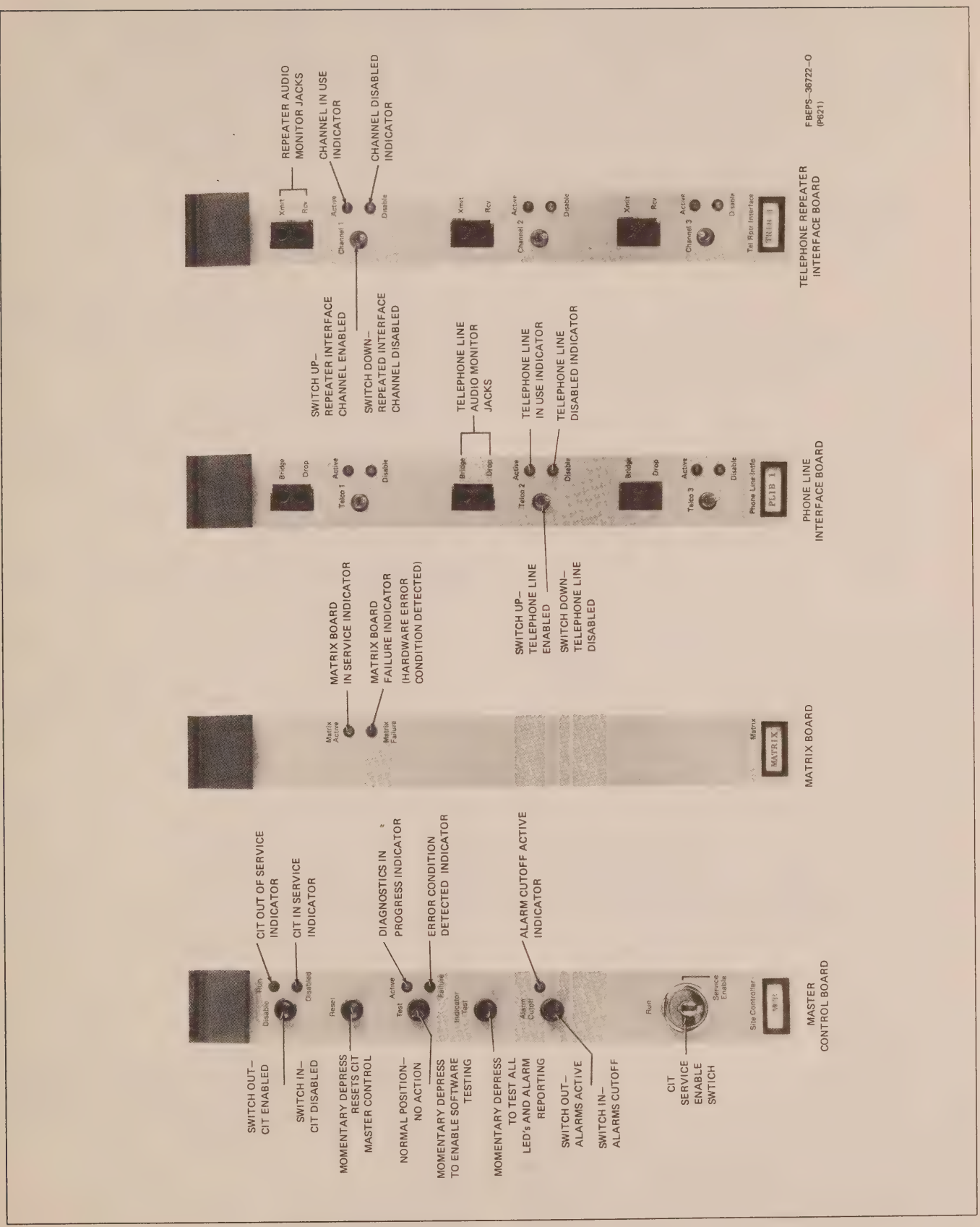

Figure 4B. Module Controls and Indicators (Models T4051 & T4052 Only)

NOTE (Cont'd.)

agnostic System Test is performed. The outcome of the test is the same as if initiated via the front panel TEST pushbutton on the CSC module.

Examples of TEST command usages follows.

NOTE

The words actually entered by the system manager are shown underlined. Each entry must be followed by a (CR) (carriage return).

GRD > **TEST**

The operator is required to re-enter the password after the TEST command is activated to access the system cotrol program.

NOTE

A simple procedure to find the cause of failure is, with alarms enabled, to either perform a manual system reset (via the CSC RESET pushbutton) or perform a system reset (via the system manager's terminal). To cause a system reset, from the terminal, the operators enters ESC *.

The following paragraph describes the trunked radio system central controller RAM and EPROM test failure indications which occur when either the CSC, RSC, or TSC module produce a test error. These indications include LED displays, printed error messages, and system reversion to FAILSOFT operation. (For models T4051 & T4052 only, any reference to a module RS-232-C port implies INTFC connector 21 and that an ACB module is inserted in the ACB2 slot.)

NOTE

The central controller modules test the RAM integrated circuits first and the EPROM integrated circuits second. If an error condition is detected during the RAM test, the EPROM test is not performed.

CSC, RSC, Or TSC Module Fails RAM Or EPROM Test

The system manager does not receive an indication that the RAM or EPROM test failed if the ALARM CUTOFF button on the respective module (CSC, RSC, or TSC) front panel is depressed when the test is initiated. The error condition is disregarded and normal program execution is attempted. If the ALARM CUTOFF button is not depressed and a terminal is not connected to the respective module RS-232-C port, the FAILURE LED is on continuously, the ACTIVE LED flashes, and the system reverts to FAILSOFT operation. If the ALARM CUTOFF button is not depressed and a terminal is connected to the respective module RS-232-C port, the FAILURE LED is on continuously, the RAM or EPROM error condition is printed at the terminal, and the system reverts to FAILSOFT operation. After a test failure is indicated, the system manager may instruct the central controller to disregard the error condition by depressing the ALARM CUTOFF button. The central controller responds by printing ERROR ACKNOWLEDGED at the terminal, if it is connected, and attempts normal program execution.

Table 5 summarizes system operation during site controller module failure.

The RESTART function provides for a total reinitialization of the system. The program automatically restarts when it detects a:

- RAM failure on CSC module, or
- EPROM failure on CSC module, or
- Master reset via module front panel or terminal, or
- Software detected error, or
- Power failure, or
- ESC * entered from system manager terminal.

Table 6 summarizes system operation during the RESTART function.

3.11 HELP COMMAND

The HELP command lists all of the GUARDIAN program commands, as follows:

GRD > **HELP**

EXIT or **BYE**

DATE
TIME
CHAN
PARM
SUBS
TEST
HELP

3.12 EXIT/BYE COMMAND

EXIT or BYE commands terminate the user interface program (GUARDIAN). Further user interface work can be resumed by re-entering the system access password, as previously described.

GRD > **BYE**
BYE FOR NOW...
ENTER PASSWORD

GRD > **EXIT**
BYE FOR NOW...
ENTER PASSWORD

Table 5. Failed Site Controller Module Summary

Description	Printed Message
CSC Module In Failed Mode: • System Reverts to FAILSOFT Operation	(Nothing)
RSC Module in Failed Mode: • CSC Works Normally • System Reverts to FAILSOFT Operation	*DIAG*CSC EO 90 HH:MM:SS MM/DD/YY (Nothing)
TSC Module in Failed Mode: • CSC Works Normally • RSC Works Normally • System Reverts to FAILSOFT Operation	*DIAG*CSC EO 90 HH:MM:SS MM/DD/YY *DIAG*RSC 20 90 HH:MM:SS MM/DD/YY (Nothing)

Table 6.
RESTART Function System Operation Summary

When the CSC Module Restarts: • RSC Module Resets • TSC Module Resets • All Variables Are Re-initialized At CSC Module
When RSC Module Restarts: • RSC Module Resets • Channel Status Updated At CSC Module • All Current Calls Are Terminated • Reassign Control Channel
When TSC Module Restarts: • TSC Module Resets • Channel Status Updated At CSC Module • All Current Calls Are Terminated • Reassign Control Channel

Example 25.

TOP —Top of queue method for channel assignment when no channel is available. Emergency call requests are put on the emergency queue and are processed as soon as a channel becomes available. Also, to free up a channel quicker, all calls (except phone calls and emergency calls) become transmission trunked.

PRE —Pre-emptive method for channel assignment when no channel is available. The lowest priority call is terminated (phone calls and emergency calls are not pre-empted). The channel assigned for the terminated call is re-assigned for an emergency call. If no call can be terminated, the aforementioned top of queue method is used.

RESERVE NN —Reserves NN channels for emergency only traffic. The valid range for NN is 0 to 18, independent of the number of channels in the system. The maximum number of channels reserved at any time equals the number of useable channels minus 2.

e.g.: For a 5-channel system, the maximum number of reserved channels is 3 (if all channels are useable) even though NN may be any value up to and including 18.

HOLD MM:SS —Changes the extended repeater hold time to the value entered. Where MM = minutes and SS = seconds. Range = 00:00 to 26:59. The hold time is added to the message trunked time-out (see PARM command) for emergency call.

LIST —List emergency call parameters.

QUIT —Exit to GRD program.

3.13 EMRG COMMAND

The EMRG command permits the system manager to examine and modify parameters associated with emergency call handling. Example 25 shows the available subcommands.

Example 26 shows how to use the EMRG command.

4. AUTOMATIC SYSTEM ALARM CAPABILITY

4.1 INTRODUCTION

The central controller is designed to alert the system manager when certain central controller or repeater malfunctions occur. This is done in two ways. One is the automatic generation of error messages on the system manager's terminal (with the system manager's terminal connected to the central controller and in the active mode). The other way is activation of an external alarm device by means of relay contacts triggered by commands from the central controller. No external alarm device is supplied with the central controller, however relay contacts are provided. Refer to paragraph 4.3 for external alarm connection details.

4.2 SYSTEM MANAGER'S TERMINAL ALARM MESSAGES

4.2.1 General

The system manager's terminal automatically prints out alarm messages if, and only if, the following conditions are met:

All Models

- The central controller is active
- A central controller-detectable malfunction occurs in either the central controller or a base-repeater station

Models T4051 & T4052

- The system manager's terminal is connected to the central interconnect terminal and is in the active mode
- The central interconnect terminal is active

Model T5004

- The system manager's terminal is connected to the central controller and is in the active mode.

4.2.2 Message Formats (Models T4051 & T4052)

The diagnostic messages generated appear as follows:

*DIAG*XXX NN $$ tt:tt:tt dd/dd/dd

Where XXX is the three character acronym for the site that initiated the message.

Currently valid sites are: TSC, RSC, CSC, & ICU.

*DIAG*TSC NN $$ tt:tt:tt dd/dd/dd
*DIAG*RSC NN $$ tt:tt:tt dd/dd/dd
*DIAG*CSC NN $$ tt:tt:tt dd/dd/dd
*DIAG*ICU NN $$ tt:tt:tt dd/dd/dd

Where NN is the device address unless otherwise noted.

Where $$ is the diagnostic message.

Where tt:tt:tt is the time the diagnostic occurred in twenty-four hour format hh:mm:ss.
Where: hh = hour (00-23)

mm = minute (00-59)

ss = second (00-59)

Example 26.

```
GRD > EMRG
VALID COMMANDS ARE: LIST, TOP, PRE, HOLD, QUIT
EMGR > TOP
EMRG > LIST
HOLD T.O. = 00:30
NUMBER OF RESERVED REPEATERS = 0
EMRGENCY CALL HANDLING = TOP OF QUEUE
EMRG > RESERVE 1
EMRG > PRE
EMRG > HOLD 00:45
EMRG > LIST
HOLD T.O. =00:45
NUMBER OF RESERVED REPEATERS = 1
EMERGENCY CALL HANDLING = RUTHLESS PRE-EMPTION
EMGR > QUIT
GRD >
```

Where dd/dd/dd is the date the diagnostic occurred in standard format mm/dd/yy.

Where: mm = month 00 (indicates default condition) 01-12

dd = day 00 (indicates default condition) 01-31

yy = year 00-99

DEVICE ADDRESSING

$00-$14 —RIB device for all RSC sourced diagnostic messages.
$00-$1D —PLIB device for all ICU sourced diagnostic messages.
$20 —RSC device address.
$40-$54 —TIB device for all TSC sourced diagnostic messages.
$40-$54 —RTIB device for all ReSC sourced diagnostic messages (ReSC = Remote Site Controller)
$40-$54 —TRIB device for all ICU sourced diagnostic messages.
$60 —TSC device address.
$80 —MCB device address.
$AO —IRB device address for all RSC sourced diagnostic messages.
$CO —CRB device address for all ReSC sourced diagnostic messages.
$CO —MATRIX device address for all ICU sourced diagnostic messages.
$EO-$EF —CSC device addresses for all CSC sourced diagnostic messages.

SITE RESTART INFORMATION

*DIAG*XXX NN $$ tt:tt:tt dd/dd/dd
XXX —RSC, TSC, CSC or ICU (source of message)
$$ —90, 91, 92 or 93 (see below)
NN —device address excepted as noted

90—RSC—Hardware restart.
TSC—Hardware restart.
CSC—Hardware of software restart with battery backed data preserved.
ICU—Hardware restart with battery backed data preserved. (See note.)
91—RSC—Hardware restart due to power failure.
TSC—Hardware restart due to power failure.
ICU—Hardware restart with battery backed static RAM lost. (See note.)
92—RSC—Hardware restart with battery backed data lost.
TSC—Hardware restart with battery backed data lost.
ICU—Hardware restart with battery backed dynamic RAM lost. (See note.)
93—ICU—Hardware restart with both battery backed dynamic and static RAM lost. (See note.)

NOTE

For ICU sourced restart diagnostic messages, the NN field indicates the states of default flags rather than the device. The definition of NN is as follows:

FF—Authorization and billing in default
F0—Authorization and billing in default
0F—Billing in default mode
00—Authorization and billing active (neither in default mode)

CSC SOURCED MESSAGES

*DIAG*CSC NN $$ tt:tt:tt dd/dd/dd
NN —device number
$$ —diagnostic message listed below

error messages for device number: EE

E0—Subscriber password has been lost and replaced by the system password.
E1—A disabled fleet was reset to disabled.
F0—Time and date data lost.
F1—Parameter data lost.
F2—EDMWRK device status data lost.
F3—LOGGER weekday parameters lost.
F4—LOGGER summary data lost.
F5—ISWOSW negative subscriber list lost.
F6—A parameter value was too low.
F7—LOGGER weekend parameters lost.
F8—DRAM malfunction. Next message shows bit pattern indicating bad chip.
F9—DRAM malfunction. Next message shows address of bad byte.
FA—Bad data found in individual subscriber records.
FB—Bad data found in individual subscriber records checksums.
FC—Bad data found in subfleet records or checksums.
FD—A subscriber record was corrected. Next message shows a bit pattern indicating the corrected bit.
FE—All subscriber records have been lost.
FF—Subscriber default records have been lost.

error messages for device number: E9

01—Checksum error in WEEKDAY parameter set
02—Checksum error in WEEKEND parameter set
03—Checksum error in SPECIAL parameter set
04—Checksum error in EXCEPTION table
05—Checksum error in SYSTAT table
06—Checksum error in battery backed logger variables.

error messages for device number E8

00—EDMWRK started with no work to do.
01—EDMWRK started but unknown command received.
06—Illegal device # in status change command
1E—Illegal device # in BSI command
20—TSC link malfunctioned.
21—TIB 1 malfunctioned.
22—TIB 2 malfunctioned.
23—TIB 3 malfunctioned.
24—TIB 4 malfunctioned.
25—TIB 5 malfunctioned.
26—TIB 6 malfunctioned.
27—TIB 7 malfunctioned.
28—TIB 8 malfunctioned.
29—TIB 9 malfunctioned.
2A—TIB 10 malfunctioned.
2B—TIB 11 malfunctioned.
2C—TIB 12 malfunctioned.
2D—TIB 13 malfunctioned.
2E—TIB 14 malfunctioned.
2F—TIB 15 malfunctioned.
30—TIB 16 malfunctioned.
31—TIB 17 malfunctioned.
32—TIB 18 malfunctioned.
33—TIB 19 malfunctioned.
34—TIB 20 malfunctioned.
35—TIB 21 malfunctioned.

40—RSC link malfunctioned.
41—RIB 1 malfunctioned.

42—RIB 2 malfunctioned.
43—RIB 3 malfunctioned.
44—RIB 4 malfunctioned.
45—RIB 5 malfunctioned.
46—RIB 6 malfunctioned.
47—RIB 7 malfunctioned.
48—RIB 8 malfunctioned.
49—RIB 9 malfunctioned.
4A—RIB 10 malfunctioned.
4B—RIB 11 malfunctioned.
4C—RIB 12 malfunctioned.
4D—RIB 13 malfunctioned.
4E—RIB 14 malfunctioned.
4F—RIB 15 malfunctioned.
50—RIB 16 malfunctioned.
51—RIB 17 malfunctioned.
52—RIB 18 malfunctioned.
53—RIB 19 malfunctioned.
54—RIB 20 malfunctioned.
55—RIB 21 malfunctioned.

60—ICU link malfunctioned.
61—TRIB 1 malfunctioned.
62—TRIB 2 malfunctioned.
63—TRIB 3 malfunctioned.
64—TRIB 4 malfunctioned.
65—TRIB 5 malfunctioned.
66—TRIB 6 malfunctioned.
67—TRIB 7 malfunctioned.
68—TRIB 8 malfunctioned.
69—TRIB 9 malfunctioned.
6A—TRIB 10 malfunctioned.
6B—TRIB 11 malfunctioned.
6C—TRIB 12 malfunctioned.
6D—TRIB 13 malfunctioned.
6E—TRIB 14 malfunctioned.
6F—TRIB 15 malfunctioned.
70—TRIB 16 malfunctioned.
71—TRIB 17 malfunctioned.
72—TRIB 18 malfunctioned.
73—TRIB 19 malfunctioned.
74—TRIB 20 malfunctioned.
75—TRIB 21 malfunctioned.

F0—Entered failsoft due to: No RSC port.
F1—Entered failsoft due to: No RSC.
F2—Entered failsoft due to: No IRB.
F3—Entered failsoft due to: No RIB for control channel.
F4—Entered failsoft due to: No RIB for voice channel.
F5—Entered failsoft due to: No TSC port.
F6—Entered failsoft due to: No TSC.
F7—Entered failsoft due to: No RIB + TIB for control.
F8—Entered failsoft due to: No RIB + TIB for voice.

error messages for device number: E7

The form of a CHLWRK error essage is "E7" followed by the channel number logically OR'd with one of the following:

00-14 —RIB status update with RSC out of service.
20 —Illegal RSC command received.
21 —Illegal device # in RSC command.
40-54 —TIB status update with TSC out of service.
60 —Illegal TSC command received.
61 —Illegal device # in TSC command.
80-94 —Commands still on pending queue and call over.
F0 —Illegal intertask command received.
F1 —Illegal channel address in intertask command.
F2 —Intertask command received out of the expected sequence.
F3 —Call started for a call type not yet serviced.
F4 —Abnormal call end initiation (timer started call end).

error messages for device number: E6

01 —Unknown task command (ISW DISPATCH processor).
02 —Unknown ISW request (ISW request processor).
03 —OSW falsely referenced and ISW (OSW expiration processor).
04 —Entry had to be removed from positive subscriber queue due to a checksum error.
05 —Entry had to be removed from negative subscriber queue due to a checksum error.
06 —ICU requested a reject for a call that ISW could not find.
07 —Received a D0 or D3 out of sequence.
08 —Assigned a call to a channel and the RIB or TIB was already assigned.
09 —Assigned a call to a channel and the CCLLTO timer was already active.
10 —Assigned a call to a channel and the CERTO timer was already active.
11 —Assigned a call to a channel and the CHLTO timer was already active.
12-21 & 25 An interconnect call counter went out of range.
22 —Reserve repeater count went too low.
23 —Count of non-emergency calls went negative.
24-29 —An interconnect call counter went out of range.
32 —DCB tried assigning a call to the control channel.
33 —DCB tried assigning a call to an assigned channel.

error messages for device number: E4

00—No bins on INTFTX work queue.
01—Unknown command to INTFTX.
22—The TSC port has detected a DCD error.
23—No CTS on the the TSC port.
24—The TSC port has detected a framing error.
25—The TSC port has detected an overrun error.
26—The TSC port has detected a parity error.
27—Unknown INTFRX command.
28—Data was sent to INTFTX to be transmitted, but the TSC is not enabled.
29—ECHO sync was lost on the TSC.
2A—Receive checksum error for the TSC.
2B—Receiver buffer overflow for the TSC.
2C—Unknown ACIA error.

42—The RSC port has detected a DCD error.
43—No CTS on the RSC port.
44—The RSC port has detected a framing error.
45—The RSC port has detected an overrun error.
46—The RSC port has detected a parity error.
47—Unknown INTFRX command.
48—Data was sent to INTFTX to be transmitted, but the RSC is not enabled.
49—ECHO sync was lost on the RSC.
4A—Receive checksum error for the RSC.
4B—Receive buffer overflow for the RSC.
4C—Unknown ACIA error.

62—The ICU port has detected a DCD error.
63—No CTS on the ICU port.
64—The ICU port has detected a framing error.
65—The ICU port has detected an overrun error.
66—The ICU port has detected a parity error.
67—Unknown INTFRX command.
68—Data was sent to INTFTX to be transmitted, but the ICU is not enabled.
69—ECHO sync was lost on the ICU.
6A—Receive checksum error for the ICU.
6B—Receiver buffer overflow for the ICU.

6C—Unknown ACIA error.

error messages for device number: E2

01—UNKNOWN COMMAND
1F—STUCK OSW, (NO REVERSE REFERENCE)

ICU SOURCED MESSAGES

*DIAG*ICU NN $$ tt:tt:tt dd/dd/dd
NN —device address unless otherwise noted
$$ —diagnostic messages listed below

71—ICU was going to send a decrement command but found
-that it had already sent one
-that this is a mobile to land call
-already sent request to the SCS.
NN = call's status from the call vector.
72—PLIB returned a status of RINGING and it was just assigned to a mobile to land call. (GLARE)
NN = PLIB device address
73—PLIB returned a status of STOPPED RINGING. The PLIB is assigned and OFFHOOK for a mobile to land call.
NN-PLIB device address
74—ICU receive error from PLIB. (Two consecutive reads of the ACIA did not match.)

A0—Mobile-land call active and another grant was received for the same caller ID.
A1—Ring OSW received for a call that is in the terminate phase.
A3—An out of service PLIB with an active call received an alert tone request.

B0—Long distance memory 75% full on at least one page of DYNAMIC memory...time to do a summary
B1—Long distance memory 100% full on at least one page of DYNAMIC memory...LONG DISTANCE CALLING NOW DISABLED until a summary is generated
B2—Sixteen bytes of dynamic RAM have been violated.
NN = 80
B3—These messages indicate the address of the routine
B4—calling the STOP routine, where:
DIAG ICU XX B3 (XXYY) is the address of
DIAG ICU YY B4 routine calling STOP.
B5—A bin error has occurred in dynamic RAM
NN = 80
B6—A storage error has occurred in the Long Distance Call storage area. Records cleared.

C0—Matrix vertical failure
D0—Unknown command from the CSC.
NN = The received command.
D1—Invalid command from a PLIB.
D2—Invalid MCP command from the CSC.
NN = The received command.

E0—Invalid command from the PLI.
NN = The received command.
E1—Offhook on unassigned PLI.
E2—Offhook NOT at RING state.
E3—On-hook on unassigned PLI.
E4—Interdigit T.O. on unassigned PLI.
E5—Tone done on unassigned PLI.
E6—Digits from unassigned PLI.
E7—Unknown call processing command from the CSC.
NN = The received command.
E8—Unknown OSW status.
E9—Assignment to currently active TRIB.
EA—Alert tone command for unassigned TRIB.
EB—Alert tone command for non-voice phase call.
EC—Could not find call ID for RING OSW.
NN = OSW command opcode.
ED—Call is not L-M for RING OSW.
EE—L-M is not waiting for RING OSW.
EF—Aborting a call with an unassigned TRIB.

NOTE
All TRIB addresses refer to their physical address.

F1—TELCO malfunction (dial tone detect).
F2—Synthesizer malfunction.
F3—DTMF decoder malfunction.
F4—Minor matrix malfunction.
F5—Cut-thru relay malfunction.
F6—Multiple PLIB malfunction.

TSC/RSC SITE SOURCED MESSAGES

*DIAG*TSC NN $$ tt:tt:tt dd/dd/dd
*DIAG*RSC NN $$ tt:tt:tt dd/dd/dd
NN —device address unless otherwise noted
$$ —diagnostic messages listed below

TSC ERRORS

01— BUFFER LOAD NOT COMPLETED
02— + INTERRUPT NOT FOUND
03— + TSC-CSC ACIA ERROR
04— OSW DATA CHECKSUM ERROR
05— OSW DATA BUFFER OVERRUN
06— CH # IN OSW > 20
07— REPEAT OSW FOR DEKEYED CHNL
08— HS DATA BUFFER OVERRUN
09— ISW COMMAND RECEIVED
0A— + COMMAND CHECKSUM ERROR
0B— + CH. # IN COMMAND > 20
0C— + CMD SENT NOT RECOGNIZABLE
0D— CHNL CMD ON DISABLED CHNL
0E— ILLEGAL CMND FOR CTL CHNL
0F— + + REC'D ENABLE WHEN ENABLED
90— RESTART...LACK OF TICKLE
91— RESTART...LOSS OF POWER
92— BATTERY BACK-UP FAILURE
+ = PROGRAM RESET AFTER REPORTING ERROR
+ + = PROGRAM RESTART AFTER REPORTING ERROR

RSC ERRORS

01—UNKNOWN COMMAND
02—ASSIGNING AN ASSIGNED CHANNEL
03—BAD DEVICE ADDR ON STATUS RESPONSE CMD (09)
04—BAD DEVICE ADDR ON ENABLE CMD (0A)
05—BAD DEVICE ADDR ON DISABLE CMD (0B)
06—BAD DEVICE ADDR ON STATUS REQUEST CMD (08)
07—BAD DEVICE ADDR ON CHAN CMD (C0)
08—BAD TYPE INFO ON DATA CMD (0D)
09—FRAMING ERROR
0A—PARITY ERROR
0B—OVERRUN ERROR
0C—RECEIVER CHECKSUM ERROR
0D—ILLEGAL CMD
0E—RX OPCODE ERROR
90—RESET-TICKLE
91—RESET-POWER UP

PLIB Diagnostic Device Number to Circuit Number Reference Table

	PLIB#			PLIB#			PLIB#	
HEX =	BOARD	CKT	HEX =	BOARD	CKT	HEX =	BOARD	CKT
$00	1	1	$07	3	2	$0E	5	3
$01	1	2	$08	3	3	$0F	6	1
$02	1	3	$09	4	1	$10	6	2
$03	2	1	$0A	4	2	$11	6	3
$04	2	2	$0B	4	3	$12	7	1
$05	2	3	$0C	5	1	$13	7	2
$06	3	1	$0D	5	2	$14	7	3
						$15	8	1
						$16	8	2
						$17	8	3

GLOSSARY FOR DIAGNOSTIC MESSAGES

BB —Battery backed status RAM
CRB —Clock Recovery Board
CSC —Central Site Controller
DCB —Data Concentrator Board
ReSC —Remote Site Controller
RIB —Receiver Interface Board
RSC —Receiver Site Controller
IRB —Inbound Recovery Board
PLIB —Phone Line Interface Board
TIB —Transmitter Interface Board
TRIB —Telephone Repeater Interface Board
TSC —Transmitter Site Controller

4.2.3 Message Formats (Model T5004)

The diagnostic messages generated appear as follows:

*DIAG*XXX NN $$ tt:tt:tt dd/dd/dd

Where XX is the three character acronym for the site that initiated the message.

Currently valid sites are: TSC, RSC, CSC.

*DIAG*TSC NN $$ tt:tt:tt dd/dd/dd

*DIAG*RSC NN $$ tt:tt:tt dd/dd/dd

*DIAG*CSC NN $$ tt:tt:tt dd/dd/dd

Where NN is the device address unless otherwise noted.

Where $$ is the diagnostic message.

Where tt:tt:tt is the time the diagnostic occurred in twenty-four hour format hh:mm:ss.

Where: hh = hour (00-23)
mm = minute (00-59)
ss = second (00-59)

Where dd/dd/dd is the date the diagnostic occurred in standard format mm/dd/yy.

Where: mm = month 00 (indicates default condition) 01-12
dd = day 00 (indicates default condition) 01-31
yy = year 00-99

DEVICE ADDRESSING

$$00-$14 —RIB device for all RSC sourced diagnostic messages.
$20 —RSC device address.
$40-$54 —TIB device for all TSC sourced diagnostic messages.
$60 —TSC device address.
$A0 —IRB device address for all RSC sourced diagnostic messages.
$E0-$EF —CSC device addresses for all CSC sourced diagnostic messages.

SITE RESTART INFORMATION

*DIAG*XXX NN $$ tt:tt:tt dd/dd/dd
XXX —RSC, TSC, or CSC (source of message)
$$ —90, 91, or 92 (see below)
NN —device address except as noted
90—RSC—Hardware restart.
TSC—Hardware restart.
CSC—Hardware or software restart with battery backed data preserved.
91—RSC—Hardware restart due to power failure.
TSC—Hardware restart due to power failure.
92—RSC—Hardware restart with battery backed data lost.
TSC—Hardware restart with battery backed data lost.

CSC SOURCED MESSAGES

*DIAG*CSC NN $$ tt:tt:tt dd/dd/dd
NN —device number
$$ —diagnostic message listed below

error messages for device number EE

E0—Subscriber password has been lost and replaced by the system password.
E1—A disabled fleet was reset to disabled.
F0—Time and date data lost.
F1—Parameter data lost.
F2—EDMWRK device status data lost.
F3—LOGGER weekday parameters lost.

F4—LOGGER summary data lost.
F5—ISWOSW negative subscriber list lost.
F6—A parameter value was too low.
F7—LOGGER weekend parameters lost.
F8—DRAM malfunction. Next message shows bit pattern indicating bad chip.
F9—DRAM malfunction. Next message shows address of bad byte.
FA—Bad data found in individual subscriber records.
FB—Bad data found in individual subscriber records checksums.
FC—Bad data found in subfleet records or checksums.
FD—A subscriber record was corrected. Next message shows a bit pattern indicating the corrected bit.
FE—All subscriber records have been lost.
FF—Subscriber default records have been lost.

error messages for device number: E9

01—Checksum error in WEEKDAY parameter set
02—Checksum error in WEEKEND parameter set
03—Checksum error in SPECIAL parameter set
04—Checksum error in EXCEPTION table
05—Checksum error in SYSTAT table
06—Checksum error in battery backed logger variables.

error messages for device number: E8

00—EDMWRK started with no work to do.
01—EDMWRK started, but unknown command received.
06—Illegal device # in status change command.
1E—Illegal device # in BSI command.

20—TSC link malfunctioned.
21—TIB 1 malfunctioned.
22—TIB 2 malfunctioned.
23—TIB 3 malfunctioned.
24—TIB 4 malfunctioned.
25—TIB 5 malfunctioned.
26—TIB 6 malfunctioned.
27—TIB 7 malfunctioned.
28—TIB 8 malfunctioned.
29—TIB 9 malfunctioned.
2A—TIB 10 malfunctioned.
2B—TIB 11 malfunctioned.
2C—TIB 12 malfunctioned.
2D—TIB 13 malfunctioned.
2E—TIB 14 malfunctioned.
2F—TIB 15 malfunctioned.
30—TIB 16 malfunctioned.
31—TIB 17 malfunctioned.
32—TIB 18 malfunctioned.
33—TIB 19 malfunctioned.
34—TIB 20 malfunctioned.
35—TIB 21 malfunctioned.

40—RSC link malfunctioned.
41—RIB 1 malfunctioned.
42—RIB 2 malfunctioned.
43—RIB 3 malfunctioned.
44—RIB 4 malfunctioned.
45—RIB 5 malfunctioned.
46—RIB 6 malfunctioned.
47—RIB 7 malfunctioned.
48—RIB 8 malfunctioned.
49—RIB 9 malfunctioned.
4A—RIB 10 malfunctioned.
4B—RIB 11 malfunctioned.
4C—RIB 12 malfunctioned.
4D—RIB 13 malfunctioned.
4E—RIB 14 malfunctioned.
4F—RIB 15 malfunctioned.
50—RIB 16 malfunctioned.
51—RIB 17 malfunctioned.
51—RIB 18 malfunctioned.
53—RIB 19 malfunctioned.
54—RIB 20 malfunctioned.
55—RIB 21 malfunctioned.

F0—Entered failsoft due to: No RSC port.
F1—Entered failsoft due to: No RSC.
F2—Entered failsoft due to: No IRB.
F3—Entered failsoft due to: No RIB for control channel.
F4—Entered failsoft due to: No RIB for voice channel.
F5—Entered failsoft due to: No TSC port.
F6—Entered failsoft due to: No TSC.
F7—Entered failsoft due to: No RIB + TIB for control.
F8—Entered failsoft due to: No RIB + TIB for voice.

error messages for device number: E7

The form of a CHLWRK error message is "E" followed by the channel number logically OR'd with one of the following:

00-14 —RIB status update with RSC out of service.
20 —Illegal RSC command received.
21 —Illegal device # in RSC command.
40-54 —TIB status update with TSC out of service.
60 —Illegal TSC command received.
61 —Illegal device # in TSC command.
80-94 —Commands still on pending queue and call over.
F0 —Illegal intertask command received.
F1 —Illegal channel address in intertask command.
F2 —Intertask command received out of the expected sequence.
F3 —Call started for a call type not yet serviced.
F4 —Abnormal call end initiation (timer started call end.)

error messages for device number: E6

01 —Unknown task command (ISW DISPATCH processor).
02 —Unknown ISW request (ISW request processor).
03 —OSW falsely referenced and ISW (OSW expiration processor).
04 —Entry had to be removed from positive subscriber queue due to a checksum error.
05 —Entry had to be removed from negtive subscriber queue due to a checksum error.
07 —Received a D- or D3 out of sequence.
08 —Assigned a call to a channel and the RIB or TIB was already assigned.
09 —Assigned a call to a channel and the CCLLTO timer was already active.
10 —Assigned a call to a channel and the CERTO timer was already active.
11 —Assigned a call to a channel and the CHLTO timer was already active.
12-21 & 25 —An interconnect call counter went out of range.
22 —Reserve repeater count went too low.
23 —Count of non-emergency calls went negative.
24-29 —An interconnect call counter went out of range.
32 —DCB tried assigning a call to the control channel.
33 —DCB tried assigning a call to the assigned channel.

error messages for device number: E4

00—No bins on INTFTX work queue.
01—Unknown command to INTFTX.
22—The TSC port has detected a DCD error.
23—NO CTS on the TSC port.
24—The TSC port has detected a framing error.
25—The TSC port has detected an overrun error.
26—The TSC port has detected a parity error.

27—Unknown INTFRX command.
28—Data was sent to INTFTX to be transmitted, but the TSC is not enabled.
29—ECHO sync was lost on the TSC.
2A—Receive checksum error for the TSC.
2B—Receiver buffer overflow for the TSC.
2C—Unknow ACIA error.

42—The RSC port has detected a DCD error.
43—No CTS on the RSC port.
44—The RSC port has detected a framing error.
45—The RSC port has detected an overrun error.
46—The RSC port has detected a parity error.
47—Unknown INTFRX command.
48—Data was sent to INTFTX to be transmitted, but the RSC is not enabled.
49—ECHO sync was lost on the RSC.
4A—Receive checksum error for the RSC.
4B—Receive buffer overflow for the RSC.
4C—Unknown ACIA error.

error messages for device number: E2

01—UNKNOWN COMMAND
1F—STUCK OSW, (NO REVERSE REFERENCE)

TSC/RSC SITE SOURCED MESSAGES

*DIAG*TSC NN $$ tt:tt:tt dd/dd/dd
*DIAG*RSC NN $$ tt:tt:tt dd/dd/dd
NN —device address unless otherwise noted
$$ —diagnostic messages listed below

TSC ERRORS

01— BUFFER LOAD NOT COMPLETED
02— +INTERRUPT NOT FOUND
03— +TSC-CSC ACIA ERROR
04— OSW DATA CHECKSUM ERROR
05— OSW DATA BUFFER OVERRUN
06— CH # IN OSW > 20
07— REPEAT OSW FOR DEKEYED CHNL
08— HS DATA BUFFER OVERRUN
09— ISW COMMAND RECEIVED
0A— +COMMAND CHECKSUM ERROR
0B— +CH. # IN COMMAND > 20
0C— +CMD SENT NOT RECOGNIZABLE
0D— CHNL CMD ON DISABLED CHNL
0E— ILLEGAL CMND FOR CTL CHNL
0F—+ +REC'D ENABLE WHEN ENABLED
90— RESTART...LACK OF TICKLE
91— RESTART...LOSS OF POWER
92— BATTERY BACK-UP FAILURE
+ =PROGRAM RESET AFTER REPORTING ERROR
+ + =PROGRAM RESTART AFTER REPORTING ERROR

RSC ERRORS

01—UNKNOWN COMMAND
02—ASSIGNING AN ASSIGNED CHANNEL
03—BAD DEVICE ADDR ON STATUS RESPONSE CMD (09)
04—BAD DEVICE ADDR ON ENABLE CMD (0A)
05—BAD DEVICE ADDR ON DISABLE CMD (0B)
06—BAD DEVICE ADDR ON STATUS REQUEST CMD (08)
07—BAD DEVICE ADDR ON CHAN CMD (C0)
08—BAD TYPE INFO ON DATA CMD (0D)
09—FRAMING ERROR
0A—PARITY ERROR
0B—OVERRUN ERROR
0C—RECEIVE CHECKSUM ERROR
0D—ILLEGAL CMD
0E—RX OPCODE ERROR
90—RESET-TICKLE
91—RESET-POWER UP

GLOSSARY FOR DIAGNOSTIC MESSAGES

BB —Battery backed static RAM
CSC —Central Site Controller
RIB —Receiver Interface Board
RSC —Receiver Site Controller
IRB —Inbound Recovery Board
TIB —Transmitter Interface Board
TSC —Transmitter Site Controller

4.3 RELAY-ACTIVATED EXTERNAL ALARMS

The central controller is provided with two sets of dry relay contacts labeled MAJOR ALARM and MINOR ALARM. Refer to Figures 1 and 5. Both sets of relay contacts are normally closed (energized) indicating that a no-alarm condition exists. When a specific alarm condition occurs, the appropriate relay contacts open.

The MAJOR ALARM relay contacts open when any of the following malfunctions occur:

- ac power to the central controller is lost, or
- failure of any site controller board modules, or
- failure of the inbound recovery board (IRB) module.

The MINOR ALARM relay contacts open when any of the following faults occur:

- failure of a voice channel transmitter, or
- interference on a voice channel receiver, or
- failure of a tone detector on any receiver interface board (RIB) module.

The characteristics of the relay contacts are:

- maximum current rating: 100 milliamperes, and
- maximum voltage applied: 28 volts dc.

No external alarm devices are supplied by Motorola, but any suitable alarm devices can be used, provided the devices operate within the current and voltage ratings of the relay contacts, as specified.

5. AUTOMATIC SYSTEM IDENTIFICATION

The Motorola 800 MHz Trunked Radio System complies with the automatic base station identification (BSI) rule set forth by the Federal Communications Commission (FCC). Consequently the Motorola Trunked Radio System automatically transmits the FCC assigned BSI characters on the lowest available active system channel every 30 minutes. International Morse Code is used for the transmission and the BSI is transmitted at a speed of 17 words per minute.

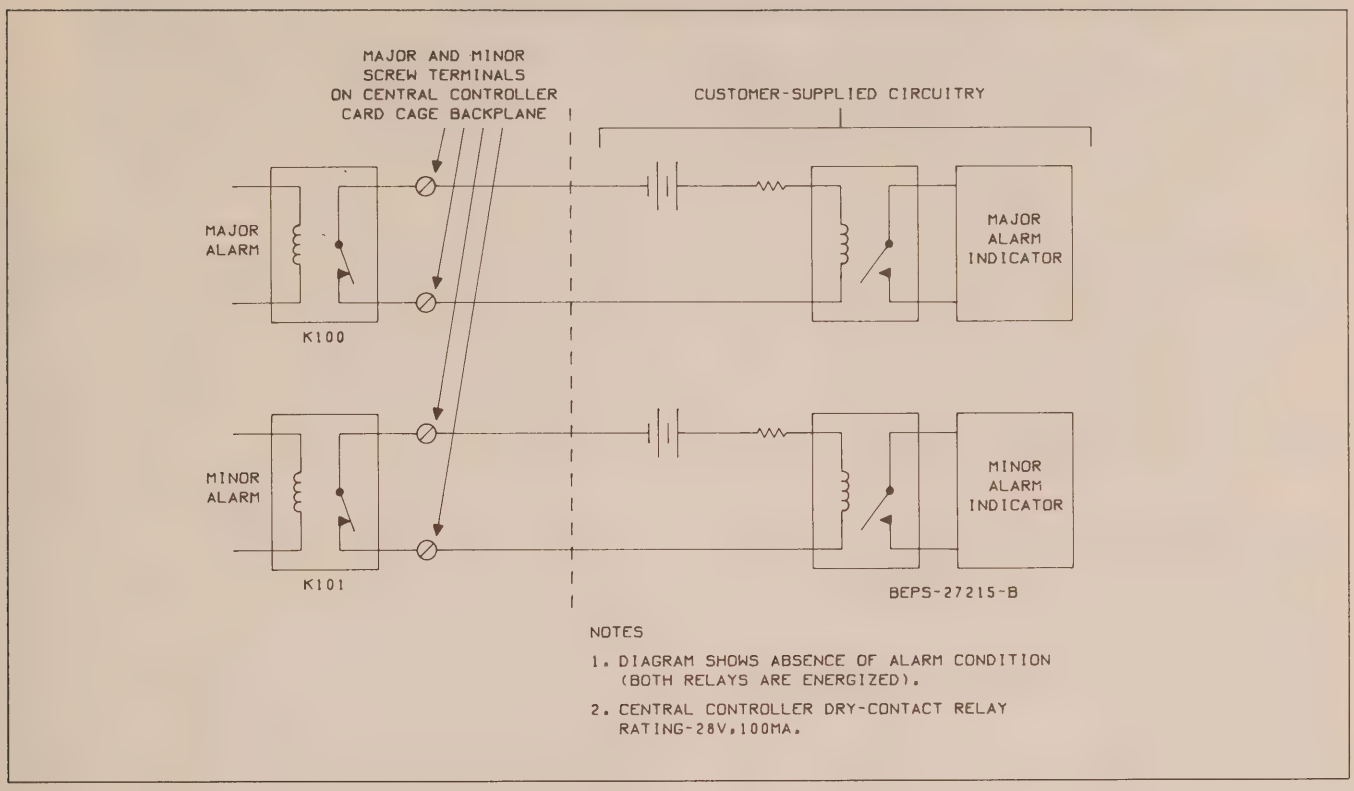

Figure 5. Typical Major and Minor Alarm Circuitry

If the lowest assigned system frequency is active with voice traffic at the time of identification transmission, the central controller delays the BSI transmission until traffic activity ceases on the lowest system frequency. Morse Code transmission of the BSI, on the lowest enabled system channel, then takes place.

6. TRUNKED SYSTEM FLEET CONFIGURATION

6.1 STANDARD FLEET CONFIGURATION

The Standard Motorola 800 MHz Trunked Radio System accommodates four types of fleet configurations, as shown in Table 7. The maximum number of each type of fleet that can be handled on one system has been standardized as indicated in the table with smaller fleet sizes predominating.

This fleet partitioning scheme makes provisions for up to 306 fleets which may comprise up to 9216 mobile units and control stations. This addressing capability greatly exceeds the traffic-handling capability of even 20-channel trunked systems.

Table 7. Motorola Trunked Radio System Standard Fleet Configurations

Fleet Type	Maximum Number of Individuals	Subfleets Per Fleet	Maximum Number of This type of Fleets in System
A	16	3	225
B	64	7	32
C	128	7	16
D	512	15	2

6.2 OPTIONAL FLEET CONFIGURATIONS

6.2.1 General

Optionally, a system may be ordered with special fleet mapping.

Table 8 shows the new choices for a fleet map. In general, the larger the fleet capacity desired on the system, the fewer the fleets one is able to accommodate.

Each fleet type has been given a letter to represent the type of size code (A — Q). In order to evaluate the selection of the fleet type alternatives available on any given trunked system, a weighted system is used. A maximum total of 8 points can be allocated for a single trunked system. If desired, 8 different fleet types (each one only one point in weighted value) can be chosen for

Table 8. Optional Fleet Configurations

Size Code	Weighted Points	Fleets	Subfleets Per Fleet	Max. Unit ID's Per Fleet
A*	1	128	3	16
B*	1	16	7	64
C*	1	8	7	128
D*	1	1	15	512
E	1	64	3	32
F	1	32	7	32
G	1	32	3	64
H	1	16	3	128
I	1	8	3	256
J	1	4	7	256
K	1	2	15	256
M	2	1	15	1,024
O	4	1	15	2,048
Q	8	1	15	4,096

*Standard fleet types -- (2) each in a standard fleet map.

the systems. One of each fleet types A — H would be an example. Otherwise, any combination, or even 8 points, all of one fleet type, can be selected.

6.2.2 System Examples

An example of utilizing the new fleet sizes is illustrated as follows:

1. A city-wide system is begun with a 5-channel system for the public works department. One major department is set up as two major fleets -- water and street maintenance. They each start on a "D"-size fleet, each with 270 units.

2. One year after the system has become operational, the central controller is upgraded to include dynamic regrouping capability and emergency call. Ten new repeaters are installed and both the police and fire departments, with 400 units each, begin to be phased in -- each using a "D"-size fleet. A total of 1,340 units are operational.

3. One of the requirements the city considers important is for all the police and fire units to be able to access an All-Call Channel. One subfleet in an "O"-type fleet has been set up with the ID capacity of 2,048. Each police and fire vehicle will be equipped with this fleet/subfleet access. Finally, a neighboring community is also now planning to install a trunked system. Another subfleet of the All-Call fleet has been set aside for the mutual-aid group so that any of the police or fire vehicles of either community, as required, can access that subfleet. The resulting fleet map has been established that now utilizes four "D"-size fleets, and one "O"-size fleet -- a total of 8 weighted points.

4. The fleet size configuration allows for extra subfleets in the fleets so that dynamic regrouping may be created. However, there are no extra whole fleets that can be created because all fleets are used. If a "I"-, "J"-, or "K"-type size code were used in place of one of the "D"-size fleets, additional fleet capacity would have been available.

6.2.3 Mobile/Portable

The optional fleet map for a system allows various configurations of units. However, only new *Smartnet* capable radios can be utilized in the new fleet size codes (size codes E — Q). All other radios, including standard *Mostar, Traxar, SYNTOR X, SYNTOR X2,* TMX, or TMXE can work on a system that has some new configurations, but only if the system is also programmed with the appropriate old fleet size codes A — D.

In all respects, the fleet map configuration chosen for the unit is transparent to the operator.

One should note that if there is a modification required of the fleet size, for instance, to allow more units beyond the limit of the original fleet size, code plugs need to be modified in all units in the field in order to change fleet types (and allow more capacity).

Also, when a system that has been in operation for a period of time requires a change in the fleet map, if no mobiles have been assigned within a particular size code group, then the size code can be exchanged without affecting units already on the system.

7. SYSTEM CALL (OPTIONAL)

System call is an optional feature that is primarily available for system managers. This option allows the system manager to transmit a message to every unit on the system, interrupting any calls in progress. The system manager can use this feature to simultaneously notify all users of important or urgent information.

8. TRUNKED INTERCONNECT BILLING THEORY OF OPERATION

NOTE
This section describes V3.53 software and subsequent releases.

8.1 GENERAL

Centralized Interconnect on a trunked system uses a shared line concept, which is similar to the basic trunking concept of shared channels for everyday dispatch traffic. Sharing phone lines results in a cost effective approach when utilized by many users. The BILLING software internal to the interconnect system can keep track of and compute each user's portion of the total phone bill. This part of the BILLING function is referred to as the TELCO BILLING.

The other billing function that the software performs is AIRTIME BILLING. This billing mechanism keeps track of how much voice channel airtime is used by the mobile placing or receiving a phone call and calculates a charge for each call based on the rate that the system owner wishes to charge.

Running totals for both the AIRTIME and TELCO charges are maintained internally by the interconnect system on a per mobile basis. Summary software routines exist that format the information and send it to the system owner's printer/terminal upon command.

Explanations and examples of the software commands are given in this manual (System Manager's Operating Manual 68P81065E15). Reference should be made to applicable sections of this manual as required.

This section gives an "inside look" at how the AIRTIME and TELCO BILLING works. That is, when a call is placed, how does the interconnect system bill for that call? With this kind of basic understanding, one can better use the BILLING function and take full advantage of its versatility.

8.2 AIRTIME BILLING

8.2.1 General

The AIRTIME BILLING function can be done two ways. The system owner must choose between the FLAT or VARIABLE methods. When one method is initially chosen, the INIT routine prompts the system manager for all the parameters associated with the method. Any "unused" parameters, such as AIRTIME RATES 2 — 6 when using the FLAT method, are set automatically to default values by the INIT routine. Actually, all of the internal parameters are used when a call is billed, regardless of which method was chosen. Entering a choice for the method merely tells the INIT routine what questions to prompt the system manager for and how to fill up the billing parameter table. This same approach is used for the TELCO BILLING function, too.

The billing parameter table is listed with the LAIR command (paragraph 3.9.2) and modified with the MAIR command (paragraph 3.9.5).

8.2.2 Call Example -- Billing

The following steps illustrate what happens at the end of an interconnect call to bill for the airtime used. Again, this process is method (flat/variable) independent, which means it works the same way every time.

Mobile-to-land and land-to-mobile Individual and Subfleet calls are billed as follows:

THE CALL ENDS . . . .

1. Calculate call duration in seconds and add it to the unit record.

2. Check amount of airtime used by this mobile unit so far in the present billing period.

   If the total amount of airtime used by this unit, including this call, is not over the amount of FREE MINUTES, then do not bill for this call, but do update the total amount of airtime used by this unit.

   If the total amount of airtime used is over the FREE MINUTES by an amount that is less than the duration of this last call, then bill for the amount that is over the FREE MINUTES and update the airtime used by this unit. For example, if each mobile is allowed 30 FREE MINUTES of airtime and a particular unit has used 28 minutes of airtime so far and then makes a 3 minute call, the charges assessed for this call will be for 1 minute of airtime.

   (28 + 3 = 31, 31 - 30 = 1 minute)

   If the total amount of airtime used is over the FREE MINUTES amount by more than the duration of this last call, then bill only for the duration of this last call and update the airtime used by this unit. For example, for a system where 30 FREE MINUTES of airtime are allowed and a mobile has used 31 minutes of airtime and places a 3 minute call, the charges assessed will be for the full 3 minutes.

3. Determine the airtime rate ($/minute) to use:

   — from the current day of week, determine which table to use, weekday or weekend.

— from the hour that the call as made (0 — 23), determine which rate to use (1 — 6).

4. Calculate the call charges (bill by the second)

   Airtime Charges = (call duration) X (AIRTIME RATE)

5. Add the airtime call charges to the unit record (fixed charges are added and tax is calculated at summary time.) The unit record to which airtime charges are added is the record corresponding to the 4-digit land-to-mobile ID.

NOTES:

1. Since the bill for each call is rounded to an increment of 1 cent, the total amount of airtime used by all the units on the system multiplied by the airtime rate (assuming that all six rates are the same) does not generally equal the dollar amount that the airtime summary shows for the entire system. This divergence is normal and represents a very small percentage of the bill (cents compared to dollars).

2. The FREE MINUTES are the number of minutes per month that the user can talk without being charged (beyond the MINIMUM FEE, that is).

3. The airtime call duration is basically the amount of airtime used for the call on the voice channel to which it was assigned by the central controller. For example, in a mobile-to-land call, the "airtime clock" starts as soon as the mobile hears dial tone, and stops when the call is ended, either by the mobile "hanging up" or by the land party hanging up, whichever happens first. However, if the mobile can not successfully enter a valid phone number and the central controller terminates the call, the airtime billing routine does not bill for the time used.

4. Airtime call duration in a land-to-mobile call is calculated from the time that the mobile answers until the time at which the call is ended, either by the mobile or land party hanging up, or by the call timing out, whichever is first. Unanswered land-to-mobile calls are not billed since they use no voice channel resources. The airtime billing ends when the land party hangs up or the call times out for land-to-mobile subfleet calls. The interconnect system can not detect the land party hanging up on systems with loop start phone lines.

8.2.3 Airtime Billing Period Rollover

At 12:00 A.M., on the airtime BILLING START DATE, the present period totals become the last period totals, and the present period records start over at zero. This shift is performed so that last month's bills can be referred to while they are being collected. Note that the AIRTIME BILLING START DATE can be set independently of the TELCO START DATE.

8.3 TELCO BILLING

8.3.1 General

The TELCO BILLING mechanism is designed to calculate each user's share of the monthly phone bill from the local telephone company (TELCO). Due to the complexity involved with calculating call charges for calls to area codes that are billed as "TOLL" calls (long distance) by the phone company (i.e., calling an exchange in New York from a system in Chicago), they are not calculated, but, rather, a call record is created and stored in memory that keeps track of who called which long distance phone numbers, for how long, and at what time. Of course, such calls as these can be denied by using the proper authorization levels for the system users. A common approach is to let the mobiles direct dial any phone number for which the billing mechanism can calculate call charges, which is normally many of the exchanges in the local area code, and make the mobiles use their local telephone company credit card to call an occasional long distance number. Credit card calls are done is most areas by dialing "0" and then the area code and phone number. The billing software records all credit card calls (0+) in the long distance memory just in case the mobile can convince the operator to let the call go through without identifying their credit card number. If this happens, the system owner can match up the bill from the phone company to the long distance call summary to see who pays for that call.

The majority of billing work done internally by the interconnect system is calculating the phone charges for each call to numbers that are "local" (approximately 98% of all calls). This, of course, is mobile-to-land calls only. The billing software allows the system owner to choose one of three possible TELCO BILLING METHODS to accomplish this. The correct choice depends on how the local TELCO assesses its call charges. Determining how the local TELCO does its billing can normally be found in a local telephone directory or by calling the phone company. The three billing methods are:

1. FLAT METHOD

   The TELCO charges a flat fee for the telephone line each month and allows unlimited calling to selected exchanges. All other numbers are "Toll", and are charged at a rate dependent on the phone number dialed, the duration of the call, and the time of day at which the call is made. The allowed exchanges under the flat rate method are entered into the interconnect system by the owner as "free" exchanges. Calls to "Toll" numbers are recorded in long distance memory.

2. METERED METHOD

   The TELCO charges a monthly fee for the line, and charges a fixed fee (e.g., $ .25) for each call to selected exchanges. The duration of these calls is unlimited. That is, each call costs $ .25, no matter how long the call lasts. These selected exchanges are entered into the interconnect system memory by the owner as "metered" exchanges. All other phone numbers are treated as "Toll", and, if the mobile is authorized to dial "Toll" numbers, the calls are recorded in long distance memory.

3. VARIABLE METHOD

   The TELCO charges a fixed monthly fee for the line, as usual, and assesses charges for each call to selected exchanges based on which exchange is called and how long the call lasts. The system manager must determine the exchange rates for these variable rate exchanges from the TELCO and enter them into the interconnect memory as the VARIABLE RATE EXCHANGES. All other phone numbers are treated as "Toll".

Calculating the TELCO DURATION is somewhat more complicated than calculating the AIRTIME DURATION. Since the interconnect system TELCO billing function should mimic what the phone company charges for each call, close approximations for the start and stop times are sought, as well as knowing the difference between a call that really went through and one that was unanswered and, hence, no TELCO charges should be generated. The "stop time" is easy. It is when either the mobile or land party hangs up the call. The "start time" is a little more difficult to determine since the interconnect system is not a phone company central office with all the equipment for signaling call states between itself and, possibly, other central offices. To get around the problem of TELCO billing for unanswered or busy calls, the system manager may elect to use the answer threshold function.

8.3.2 Answer Threshold

The answer threshold is a time duration (0-60 seconds) that the system manager specifies for each phone line with the TELL P command. This time duration is the threshold that a mobile-to-land (M-L) call must be beyond before the interconnect system "registers" the call as one that really went through and was answered at the land end. For example, if the threshold is set to 30 seconds and the time between the last digit of the phone number being entered by the mobile and the end of the call is only 20 seconds then no internal TELCO billing is processed. The called party was busy or did not answer and the mobile ended the call. The local phone company does not charge for the call and neither does the interconnect system (actually only airtime charges are assessed). Using the threshold improves the accuracy of the TELCO billing, bringing down the number of "overcharges" for the calls that were busy or unanswered. The answer threshold has no effect on land-to-mobile calls.

8.3.3 Call Example -- TELCO BILLING

To understand how the TELCO BILLING works inside the interconnect system, the following example is given. (Refer to Figure 6.)

No matter what method is specified, the billing of a call is always done the same way. All of the table entries are utilized. The common TELCO billing parameters are listed with the LTEL command (paragraph 3.9.3) and modified with the MTEL command (paragraph 3.9.6). The rates to dial particular exchanges are listed with the LEXC command (paragraph 3.9.4) and modified with the MEXC commands (paragraph 3.9.7).

THE CALL ENDS

1. If the number dialed was a toll number, a long distance call record is generated and stored in memory. Toll numbers are simply numbers for which the interconnect system does not know how to calculate call charges. They can be exchanges within the same area code; or, most often, exchanges in another area code. Toll exchanges in the local area code are identified as such by the LEXC command as having an exchange rate of "15,15". Exchanges in other area codes are assumed to be toll exchanges if they have not been entered into the system memory as a NEARBY AREA CODE EXCHANGE.

2. If the number dialed was not a toll number, then the normal process of determining the rate, multiplying the rate by the call duration to get the call charges, and adding the call charges to the user's records proceeds as follows:

   A. Retrieve the EXCHANGE RATE from the local exchange rate table or from a nearby area code exchange rate entry. The format is XX, YY, where XX is the number of UNITS for the INITIAL BILLING PERIOD and YY is the number of UNITS for the THEREAFTER

TIME PERIODS. A unit is a measure of phone service related to how long the call and how far away. Even if the local phone company does not explicitly use the Unit System, the interconnect system can be set up using the Unit System to closely approximate the way the local TELCO does their billing. Using the Unit System internally provides the versatility required to imitate several ways that the phone companies do their billing.

B. The INITIAL BILLING PERIOD is the minimum amount of time, at the beginning of a call, for which call charges are calculated. Normally, the initial billing period is for 3 minutes. If the initial billing period is 3 minutes and a call is made that lasts for less than 3 minutes, the call is billed for 3 minutes. The amount of the bill, in this case is the number of units for the initial billing period as specified by the "XX" in the exchange rate. Each call is always billed for the full initial billing period.

If the call duration goes beyond the initial billing period, then units are assessed depending on how long the THEREAFTER TIME PERIODS are, how many were used, and how many units per thereafter time period are to be charged. The thereafter time period is usually 1 or 2 minutes. It depends on how many units the initial billing period costs. The initial billing cost, again, is specified as the "XX" in the exchange rate and can range from 0 to 15. The system manager must fill in the THEREAFTER TIME PERIOD TABLE with the correspondig number of minutes. Each THEREAFTER TIME PERIOD is for each of the possible initial unit charges from 0 to 15.

C. Determine the total number of units used for this call. If the phone number dialed is 991-1000, the exchange rate is seen to be 03,01 (Circle "A", Figure 6). The thereafter time period is shown as 2 minutes for calls to exchanges that are assessed 3 units for the initial billing period (Circle "B", Figure 6). The initial billing period is 3 minutes. So, the number of units to be charged is 3 units for the first 3 minutes; 1 unit for each 2 minute period used after the first 3 minutes. The time used is always rounded up to the next time boundary. For example, if the call lasts 4 minutes, then the charge is 3 units for the first 3 minutes and 1 units for the last minute. In this example, one thereafter time period was used. If the call had lasted 6 minutes, then two thereafter time periods would have been used for an additional 2 units added to the initial 3 units for a total of 5 units.

Example 27 shows more examples (refer to Figure 6 for complete TELCO BILLING call example).

D. Calculate the call charges knowing the total number of units used and the UNIT CHARGE. The call charges are:

Call Charges (cents) = Units Used X Unit Charge (cents/unit)

Add the call charges to the mobile record.

E. Calculate the taxes on the call charges and add them to the mobile record, too.

Tax = Call Charge X Tax Rate

F. Increment the count of local calls by 1 in this unit record.

NOTES

1. By using the unit structure to do the billing, a rate increase from the phone company is easily handled by merely changing the UNIT CHARGE.

2. "Free" exchanges (or those covered under the flat billing method) have exchange rates of 00,00 which always results in $0.00 being added to the mobile account at the end of the call.

3. "Metered" exchanges show up as having an exchange rate of 01,00 which results in 1 units being charged for the call. The unit charge, in this case, is set to equal the "CHARGE PER METERED CALL".

4. If a non-zero ANSWER THRESHOLD is used, then the M-L calls must be over the threshold before they are logged. Every individual L-M call that the mobile answers generates a record. Finally, every subfleet L-M call that is assigned a channel also generates a call record.

5. LOGGING has no affect on the normal TELCO billing process. That is, a call to an exchange that adds a unit charge amount to that mobile account is not affected by the logging function generating a call record.

6. When LOGGING is used in conjunction with PBX Processing (described

```
GRD > BILL
? LEXC

THIS IS THE EXCHANGE RATE INFORMATION FOR SYSTEM 0509.
AREA CODE—312
FEDERAL TAX Y
STATE TAX Y
LOCAL TAX Y
LOCAL AREA CODE EXCHANGE RATES:
```

EXCH	0	1	2	3	4	5	6	7	8	9
200	03,01	02,01	03,01	06,02	01,01	00,00	02,01	03,01	10,02	15,05
210	09,03	03,01	04,02	00,00	04,01	06,02	01,00	05,01	11,03	01,00
|	|	|	|	|	|	|	|	|	|	|
|	|	|	|	|	|	|	|	|	|	|
|	|	|	|	|	|	|	|	|	|	|
990	01,01	03,01 **A**	09,02	10,01	12,02	02,01	04,01	01,00	00,00	00,00

```
AREA CODE—414
FEDERAL TAX Y
STATE TAX N
LOCAL TAX N
EXCHANGE RATES—
576  01,00
872  06,01
415  04,01
690  05,01
END OF RETRIEVAL
AREA CODE—815
FEDERAL TAX Y
STATE TAX Y
LOCAL TAX Y
EXCHANGE RATES—
892  03,01
668  02,01
END OF RETRIEVAL
END OF RETRIEVAL
?
```

EXCHANGE RATE FOR 991-XXXX

3 UNITS FOR THE INITIAL PERIOD
1 UNIT FOR EACH THEREAFTER PERIOD

```
GRD > BILL
? LTEL
THIS IS THE TELCO BILLING INFORMATION FOR SYSTEM 0509.
METHOD—V
START DATE—1
FIXED MONTHLY FEE $75.00
LOCAL CALL LIMIT:LEVEL 1—$10.00
LOCAL CALL LIMIT:LEVEL 2—$50.00
LOCAL CALL LIMIT:LEVEL 3—$100.00
LOCAL CALL LIMIT:LEVEL 4—$999.00
UNIT CHARGE 5.29 CENTS
FEDERAL TAX 1.00%
STATE TAX 2.00%
LOCAL TAX 3.15%
INITIAL BILLING TIME PERIOD (MIN) 3
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 0  2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 1  2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 2  2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 3  2
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 4  1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 5  1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 6  1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 7  1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 8  1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 9  1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 10 1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 11 1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 12 1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 13 1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 14 1
THEREAFTER TIME PERIOD (MIN) FOR INITIAL UNIT CHARGE OF 15 1
?
```

THIS COLUMN IS THE UNIT CHARGE FOR THE INITIAL PERIOD.

THIS COLUMN IS WHERE THE DURATIONS (MINUTES) FOR THE THEREAFTER TIME PERIOD ARE TYPED IN.

2 MINUTE THEREAFTER PERIODS FOR EXCHANGE 991 SINCE 3 UNITS ARE CHARGED FOR THE INITIAL PERIOD.

B

GBEPS-40879-O

Figure 6. Call Example-TELCO BILLING

Example 27.

Duration	Exch.	Each Rate	Initial Units	Thereafter Units	Total Units
10 minutes	998	0,0	0	0	0
2 minutes	997	1,0	1	0	1
15 minutes	997	1,0	1	0	1
1 minute	998	0,0	4	0	4
2 minutes	996	4,1	4	0	4
8.1 minutes	996	4,1	4	6	10
4.9 minutes	992	9,2	9	4	13

in the paragraphs 9.5), the mobile must dial at least 1 digit before a call record is generated at the end of the call.

7. The SLNG command call record output routine prints "LAND" next to each call record that was a L-M call.

8.4 MISCELLANEOUS BILLING FACTS AND FIGURES

8.4.1 General

1. All dollar amounts are internally maintained in increments of 1 cent. Call charges are, therefore, rounded to increments of a cent.

2. Time measurements are maintained internally by increments of 1 second. Airtime charges are charged by the second, based on a dollar amount per minute rate. TELCO charges are always based on call durations rounded up to the nearest minute.

3. Billing is not done for Motorola Automatic Radio Telephone Interconnect (MARTI) *Consolette* phone calls. The MARTI is always on a single fleet which is normally a single customer and the corresponding fleet. They will provide for and pay the bill for their own phone line. The system owner may elect to charge this MARTI customer an additional flat monthly fee for interconnect airtime use of the trunked system.

4. There is room in memory for 950 LONG DISTANCE CALL RECORDS. When they become full, no-one is allowed to make a call that would result in a long distance call record being created. Instead, an error message is sent to the system manager terminal to alert him to list and clear out the records. "Long Distance" dialing is also turned off if any single unit accumulates 250 long distance records. "Long Distance" calling automatically becomes active again when the records have been cleared. The duration of the long distance call is always rounded up to the nearest increment of 1 minute when the record is printed out. Airtime charges, however, for these calls are billed using the actual length to the second.

5. The billing and authorization software is currently capable of supporting a maximum of 500 mobiles. This is not to say that each interconnect system should, or can be, loaded up to that maximum number. Each system owner must watch the traffic loads, monitoring things like dispatch busy and interconnect busy times as summarized by the SHARED SERVICE ALGORITHM. Careful scrutiny of the SHARED SERVICE output helps the system manager decide where the number of interconnect users on his system should be leveled off.

8.4.2 Exchange Rates

1. There is always room to enter rates for all the possible exchanges in the LOCAL AREA CODE. Emergency 911 is always a "free" exchange. Information 411 is always allowed and is billed as set-up in the exchange rate entry for exchange 411. The memory has room to enter up to 6 NEARBY AREA CODES with 800 exchanges each, or 10 NEARBY AREA CODES with 480 exchanges, on the average, entered for each.

2. Calls to TOLL FREE "800" numbers are always treated as free and do not appear in the Long Distance Call Summaries.

3. Calls just to the operator (0) are not allowed, since the mobile could have the operator dial any number in the world and the system could not track it since the mobile is not dialing. Emergencies can be handled by calling 411 or 555-1212, both of which will be an operator who may be able to directly assist by forwarding the call to the authorities or be able to, at least, give the mobile the correct emergency number to call, depending on where the mobile is located. Some areas have the 911 emergency number in service, which is even better.

9. TRUNKED INTERCONNECT AUTHORIZATION THEORY OF OPERATION

NOTE

This section describes V3.53 software and subsequent releases.

9.1 GENERAL

The AUTHORIZATION function not only constrains which mobiles may place and receive interconnect calls, but also restricts which phone numbers may be dialed. Typically, the authorization parameters are set up to allow the users to direct dial any phone number that is treated as a local call by the phone company. That is, phone numbers that can be dialed that add up call charges in a running total (or add nothing if it is a really close exchange that is free), and does not show up as a separate line per call on the phone bill. Toll calls are those numbers that are listed on the phone company bill on an individual basis, like calling New York from Chicago. A toll number can be inside or outside the local area code. Likewise, non-toll local calls can be inside or outside the local area code. Generally, non-toll exchanges are within the local area code and clustered around the radio system site. Sometimes, when an interconnect system is near a border between two (or more) area codes, it is not uncommon to dial a phone number in the NEARBY AREA CODE and have it treated as a local call for billing purposes by the phone company. For example, a mobile on a sysem that is in area code 815 can dial a few "free" numbers into the bordering area code 312. That same mobile could call, if so authorized, certain exchanges in his own area code, 815, that are far away and are treated as toll exchanges. All exchanges are assumed to be toll exchanges by the BILLING and AUTHORIZATION functions if nothing has been entered into the interconnect system memory about them (the exchange RATE).

9.2 AUTHORIZATION PARAMETERS

The following explains in detail each of the following parameters. For example, a typical set of parameters may look like this when edited:

EDIT 208 33
LAND TO MOBILE ID IS 1000
1. LOCAL CALL LIMIT LEVEL 2
2. AUTHORIZATION LEVEL 3
3. DTMF SIGNALING
4. HALF DUPLEX
5. 0+ DIALING ENABLED
6. 1+ DIALING ENABLED

The land-to-mobile ID is the 4-digit number that a land party would enter, once they have called the interconnect unit, to ring a mobile. This must be done from a DTMF-equipped phone or hand-held dialer (More details are presented later in the call examples.)

9.2.1 Local Call Limit Level

This parameter can be set to a number between 1 and 4. The four limit level choices are set in the BILL INIT or MTEL commands. Each level is a dollar limit threshhold. A limit level number (1-4) is assigned to each mobile and, hence, dollar threshhold is assigned indirectly. This dollar limit threshhold is the maximum amount of TELCO charges that a mobile user can accumulate before being denied access to the interconnect. They do not get dial tone in this example if they make $50.00 worth of local phone calls. See Figure 6 for the correspondence between limit Level 2 and the dollar amount that the system manager set up. When the calling is shut down for this unit, they are still able to receive incoming land-to-mobile calls. The call limits provide a throttle on the amount of liability that a mobile accumulates as far as that unit share of the phone bill.

9.2.2 Authorization Level

This parameter is probably the most important since it provides the basic constraint on what phone numbers the mobile is allowed to dial. There are five levels to choose from. The actual phone numbers that can be dialed at each level depends on what the system manager has typed into the interconnect memory in the way of exchange rates for the local and, possibly, nearby area codes. The five levels are defined as follows:

LEVEL 1	No inbound or outbound phone calls are allowed. Midnight rollover TELCO fixed fees are not added. This level can be used to "freeze" a mobile's billing records until the end of the month so it appears in the summaries with the rest of the mobiles. The mobile could be deleted from the list at that time.
LEVEL 2	Only calls to numbers that are "free" are allowed. These are exchanges that have an exchange rate of 00,00. The numbers do not have to be within the local area code. They can, just as well, be in an area code nearby. Any exchange that has been entered as free can be dialed with Level 2.
LEVEL 3	Free calls are allowed, as with Level 2, and, in addition, calls to any phone number that has had a "non-toll" echange rate entered for it. For example, calls to exchanges with rates such as 03,01 or 09,02 or 01,00 are allowed. Calls to toll exchanges are not allowed. Toll exchanges are denoted as such by an exchange rate of 15,15, or by simply not being in

the exchange list if it is in another area code.

Level 3 is the most commonly used since it allows the mobile to direct-dial any exchange for which the billing function can calculate and access TELCO charges.

LEVEL 4 — Every exchange in the local area code can be dialed. Every exchange in each of the entered (if any) nearby area codes can be dialed.

LEVEL 5 — CARTE BLANCHE -- Any exchange in any area code can be dialed.

Calls to Information, 411, are always allowed for Levels 2-5. Calls to Information, 555-1212, are allowed if the mobile can access exchange 555. Toll Free 800 numbers are allowed at each of the levels (2-5). If a "1" is required in front of any numbers, "1+" dialing has to be enabled. Phone company credit card calling is allowed at any level (2-5) if "0+" dialing is enabled for that mobile.

9.2.3 DTMF Signaling

This parameter indicates to the interconnect system how the mobile unit accomplishes dialing of phone numbers. In this case, which is normally true, dialing is done by DTMF signaling. The other alternative is TRUNKED signaling, which is not available at this time.

9.2.4 Half Duplex/Full Duplex

This parameter indicates that the mobile is a HALF DUPLEX type. This means that the radio can either transmit or receive, at a given time, and not do both at once.

The other alternative is FULL DUPLEX. A full duplex radio can transmit and receive at the same time making the conversation take place just like a regular phone call.

The interconnect system must know when the mobile is a full duplex type so that the repeat audio path in the actual repeater can be turned off. This is so that the mobile does not "talk back to itself" at full volume. There is some sidetone, however, due to the hybrid in the Telephone Repeater Interface Board (TRIB). The sidetone is present, just like any phone.

9.2.5 0+ Dialing Enabled

This parameter restricts "0+" or credit card calling. If enabled, the mobile is allowed to dial any number using his TELCO credit card. For example, one could dial 0-976-1212 to make a call to a toll number within the local area code, or 0-312-976-1212 to call a toll number in another area code. The call is billed directly to the customer's own TELCO account. The interconnect system generates no TELCO charges, but, of course, does generate airtime charges. Actually, a long distance call record is generated for each "0+" call to keep track of these calls.

Incidentally, other types of long distance credit card calling (like *MCI*) can be done just as a simple local call. The mobile can send DTMF through to enter their credit card number, etc. The "0+" parameter is not used to restrict these *MCI*-type calls.

9.2.6 1+ Dialing Enabled

The "1+" dialing parameter, shown enabled in our typical set of parameters, specifies whether or not the mobile is allowed to dial phone numbers that require a "1" in front of them; usually meaning that the number is a toll call. Unlike the "0+" parameter, the "1+" parameter being enabled does not mean that the mobile is automatically authorized to dial any phone number after the "1". For example, if a mobile on a Chicago system has "1+" dialing enabled, but only has authorization level 3, that mobile can not dial 1-212-976-1212 to call New York. An authorization level of 5 would be required.

NOTE

If toll free 800 numbers require a "1" preceding the "800", then "1+" dialing has to be enabled if the mobile is to be allowed to call these numbers. Also, see the discussion on PRE-DIGITS (paragraph 9.4) concerning digits that must be entered before the actual phone number is dialed.

9.3 CALL EXAMPLES

The following paragraphs describe what happens, as far as the Authorization Procedure, during a land-to-mobile call (L-M) or mobile-to-land call (M-L).

9.3.1 Land-to-Mobile Calls

There are two types of L-M calls:

1. **Individual --** Where the land party can call an individual mobile.

2. **Subfleet --** Where the land party can call a subfleet of mobiles.

An individual L-M call is placed as follows:

1. The land party phones the interconnect system.

2. The interconnect system answers after about 2 rings and a "go-ahead" beep is given.

3. The land party enters (on a DTMF instrument) the 4-digit L-M ID for the mobile, e.g., 1000.

4. The authorization process converts that L-M ID into a trunked ID (fleet and individual) to see if that mobile is a valid unit on the authorization list. In addition, the mobile must have an authorization level of 2 or above in order to be called.

5. If the mobile is on and within range of the system, it starts to ring. This is indicated to the land party by a "slow ring". If the mobile is out of range, turned off, or if there are no interconnect channels available, the land party hears "fast ringing" for about 30 seconds and the interconnect system tries to "find" the mobiles.

6. The mobile answers the call and the conversation takes place.

7. The call ends and the airtime used is billed to the mobile unit corresponding to the 4-digit L-M ID.

A subfleet L-M call is placed as follows:

1. The land party phones the interconnect system and waits for the go-ahead beep to enter the following number, 9XXYYYY, where the "9" denotes a subfleet call, "XX" is the subfleet number (like 01 for Subfleet 1), and "YYYY" is any L-M ID for any of the mobiles in that subfleet or a separate "dummy" L-M ID on that fleet.

2. If an interconnect channel is available, the land party hears the trunked "talk-permit" tone (just like a mobile hears on a quick-key) indicating that a communications path is set up from the land line to that entire subfleet. The conversation now takes place.

3. The call is ended either by the call timing out or the land party hanging up.

4. When the call ends, the airtime charges are assessed and added to the account associated with the 4-digit L-M ID that the land party entered.

If the mobile, associated with the 4-digit L-M ID, is already involved in an interconnect call, the land party immediately hears a "fast busy" followed by the interconnect system hanging up on them. The same "fast busy" is heard if the 4-digit L-M ID does not correspond to a mobile (an un-assigned L-M ID), or if the mobile does not have an authorization level greater than or equal to 2, or the AUTHORIZATION STATUS is INACTIVE (turned off).

9.3.2 Mobile-To-Land Calls

There are several different call types that the interconnect system is capable of processing. During the dialing phase of the phone number, digits entered by the mobile are echoed to the phone line. (Actually, they are regenerated in DTMF or PULSE DIAL form, whichever is specified in the TELL P command.) All "0+" credit card calls, however, are forced to pulse dial so that the mobile is un-keyed, in time, after entering the last digit and receiving to listen for either the "TELCO" beep tone to enter their credit card number or an operator to come on-line and request their card number. A single "0" is not echoed if it is the first digit (0+ call). It is sent to the phone company when the second digit is entered by the mobile. This prevents the operator from being dialed directly by just entering a "0".

The normal call types processed are shown in Example 28.

9.4 PRE-DIGIT PROCESSING

Some area codes are starting to use exchanges that have a 0 or 1 as the second digit (X0X,X1X exchanges) since the demand for new phone numbers is reaching the limits. These area codes are usually the larger metropolitan areas like Los Angeles and Chicago. The normal digit processsing in the interconnect system does allow the dialing of these seven digit exchanges since the 0 or 1 in the second digit makes the first three digits look like an area code being dialed. The processing mechanism therefore tries to collect ten digits (i.e., X0X-XXX-XXXX) before completing the call. There is a way to tell the digit processing software that the local area code uses X0X and X1X exchanges and that these call types should be allowed. To "turn on" this special processing, simply set the exchange rate for exchange 300 to something other than toll (which is 15,15). Then, the software allows the X0X and X1X exchanges to be dialed. With this special processing enabled, the call types processed are shown in Example 29.

In some areas, a special sequence of numbers must be dialed first to gain access to certain long distance networks, etc. The interconnect system is capable of handling five (5) such pre-digit sequences. Each sequence can be up to five digits long. Pre-Digits are specified in the AUTH P command and allow their use on a system-wide basis by all of the interconnect users. After a pre-digit sequence has been entered by the mobile, the next digit following the sequence is treated as the first digit of a phone number just like any other call. In other words, the interconnect system expects a number like one of the above call types.

Example 28.

1	XXX-XXXX	7-Digit Call
2	1-XXX-XXXX	1 + 7 = Digit Call (probably toll)
3	0-XXX-XXXX	0 + 7-Digit Credit card call
4	XXX-XXX-XXXX	10-Digit Call (probably toll)
5	1-XXX-XXX-XXXX	1 + 10-Digit Call (probably toll)
6	0-XXX-XXX-XXXX	0 + 10-Digit Credit Card Call
7	411	Information
8	1-411	Information
9	911	Emergency
10	1-911	Emergency
11	800-XXX-XXXX	Toll-Free
12	1-800-XXX-XXXX	Toll Free

Example 29.

1	X0X-XXXX	Local 7-Digit Calls
2	X1X-XXXX	Local 7-Digit Calls
3	0-XXX-XXXX	0 + 7-Digit Credit Card Call
4	1-XXX-XXX-XXXX	1 + 10-Digit Call
5	0-XXX-XXX-XXXX	0 + 10-Digit Call
6	411	Information
7	1-411	Information
8	911	Emergency
9	1-911	Emergency
10	1-800-XXX-XXXX	Toll Free

Note: With the special processing enabled, 1 + 10-digits is the only way to direct dial another area code. Credit card calls can be either 0 + 7 or 0 + 10-digits. Calls that are 0 + 7-digits go through a 10 second timeout after the 7th digit of the 7-digit number before the call is connected. This is so that time is allowed to look for an 8th digit meaning the call is a 0 + 10 type.

The pre-digit sequence facility is not intended to be used to allow dialing on a private PBX type phone system where, for example, one must dial a "9" to get an "outside" dial tone. If the interconnect system was tied to such a phone line and a "9" was typed in as a pre-digit, then calls such as 9-XXX-XXXX may work. However, the mobile does not hear the second dial tone after the "9". This is so because the actual phone line audio is not connected to the voice channel to which the mobile is assigned until all the digits are collected, processed through Authorization, and regenerated on the phone line.

PRE-DIGIT EXAMPLE

A particular phone company requires that the sequence "123" be entered to gain access to the long distance network to dial 10-digit numbers. In this case, the digits "123" would be entered as a sequence in the PRE-DIGIT TABLE by the system manager. Dialing long distance would be done as follows:

123 - XXX - XXX - XXXX

9.5 PBX PROCESSING

Private systems, or those connected to a PBX, may elect to use the PBX processing in the interconnect system. This special processing allows a mobile to dial any phone number that is made up of any length of digits. PBX systems usually take between 4 and 11 digits to complete the call. The mobile must be on the Authorization list, as usual, and have an authorization level of at least 2. The phone lines must be DTMF compatible since the PBX processing "cuts-through" the audio from the mobile to the phone line right away in the beginning of the call. The mobile DTMF digits go directly to the phone line to do the dialing. The PBX processing mechanism in the interconnect terminal does not try to collect a certain number of digits and echo them to the line as in normal processing. Instead, PBX processing lets the mobile directly dial any phone number but monitors what is being dialed. The way that the system monitors the dialed numbers is quite versatile. For example, the system manager can have the dialed digits for both land-to-mobile as well as mobile-to-land call recorded into long distance call storage using the logging function described in paragraph 8. The other way to track PBX type calls is to set the exchange rate for exchange 200 to one of three choices. Every PBX processed call will default to doing TELCO billing using the exchange rate for # 200. This is an important difference between PBX and the normal call processing.

Using exchange rate 200 works as follows:

1. Toll - Set the rate to 15,15 to record each phone number dialed in each mobile-to-land call. If logging is turned off, no records of land-to-mobile calls are kept. This is the normal choice since L-M calls do not use up call record space (limited to 950 records) which can be used for the more important M-L calls.

2. METERED - Set the rate to 01,00 to simply count the number of M-L calls made by each mobile and

not record the phone number dialed. Since the rate is 1,0 a unit charge is added to the TELCO account for each call.

3. FREE - Set the rate to 00,00 to only count the number of M-L calls placed by each mobile and not record the phone number dialed. The count is listed with the BILL STEL command.

In addition to using exchange rate 200 as mentioned above, logging can be turned on to record the phone numbers being dialed. For example, setting the exchange rate 200 to FREE (00,00) and turning LOGGING on results in a call record being generated for each M-L and L-M call, as well as a count of the number of M-L calls being kept and listed with the STEL command.

9.6 NORMAL DIGIT PROCESSING

A mobile-to-land call, using normal processing is placed as follows:

1. The user activates the interconnect switch on the mobile. If the mobile is on the Authorization List and is authorized for at least level 2, and if the mobile has not gone beyond the local call limit, and if there is an interconnect channel available, dial tone is heard. Otherwise, the mobile hears an out-of-range tone or a busy tone, specifically, for the case when there is no channel available. The dial tone heard is actually generated by the interconnect system and is not coming from the telephone company.

2. The mobile dials the telephone number just as it would be dialed at the interconnect system site. If the user is not authorized to call that number, the user hears a "fast busy" followed by the interconnect system dropping their call. Being unauthorized to make the call can be caused by any one of several things. For example, if a mobile has an authorization level of 3 and tries to call a 10-digit long distance number, the call is terminated. Or, if the mobile tries to dial 0-976-1000 and is not enabled for "0+" dialing, the call is terminated. There are many other possibilities.

3. After the mobile dials a valid, authorized phone number, the TELCO phone line audio is connected to the voice channel and the conversation takes place.

4. The call is ended by the land party hanging up, or the mobile disengaging from the interconnect mode, or by the call timing out. The time-out is an overall call duration timer and is controlled by the SHARED SERVICE ALGORITHM in the central controller.

9.7 AUTHORIZATION LIST NOTES

The system manager must enter the trunked mobile IDs into the AUTHORIZATION LIST that are to receive interconnect service. A preceding discussion (paragraph 9.2) explains each of the parameter choices.

When a mobile is added to the list, the Authorization software automatically assigns a 4-digit land-to-mobile ID. This L-M ID assignments start at 1000 and are incremented from there. If a mobile is deleted from the list, that L-M ID is the next to be assigned when another mobile is added later. The general rule is to re-assign the most recently deleted L-M ID first, and then start back on IDs that are not assigned yet. Example 30 shows L-M ID assigments.

In order for the interconnect system to make sure of the Authorization List, the AUTHORIZATION STATUS must be ACTIVE. The STATUS command in AUTH is used to activate or de-active the Authorization function. So the system manager must ACTIVATE the list after typing it into the system. If the Authorization List is not activated, only 7-digit mobile-to-land calls are allowed. No airtime or TELCO charges are assessed for these calls when Authorization is turned off.

10. SOFTWARE UPGRADE RETROFIT PROCEDURE

Upgrading the central controller software to version 3.60 or newer requires minor hardware changes to the Site Controller Board TRN5682A (part of TLN2595A) to convert from a 2-page board to a 3-page board. The revisions required apply only to TRN5682A circuit boards with Motorola part numbers 84E84405N01 and 84E84405N02 as shown on the solder side of the circuit board. The modifications required to upgrade the site controller board are described below.

10.1 SOFTWARE CHANGES

Exchange EPROMS U60 through U66 as shown in Table 9.

10.2 HARDWARE CHANGES

10.2.1 Reroute PAGE2 signal from PIA U41, pin 9 to memory select PAL U58, pin 3 as follows. (Refer to Figure 7.)

Step 1. Follow trace from U41, pin 9 to first feed-through (beyond pull-up resistor).

Step 2. Cut trace from this feed-through (Step 1) on the component side.

Step 3. Run a jumper from this feed-through to the feed-through adjacent to U58, pin 1 (remove PAL U58 to obtain access to feed-through).

Example 30.

Start Flt	Unt	L-M ID Assigned
ADD 404	000	1000
ADD 404	001	1001
ADD 404	002	1002
DELETE 404	000	--
DELETE 404	001	--
DELETE 404	002	--
ADD 100	000	1002 (re-assigned)
ADD 100	001	1001 (re-assigned)
ADD 100	002	1000 (re-assigned)
ADD 100	003	1003
ADD 100	004	1004
DELETE 100	003	--
ADD 100	005	1003 (re-assigned)
ADD 100	006	1005

Table 9. Exchange EPROM Part Numbers

EPROM	Existing Part No.	Replacement Part No.
U60	51-90008C43	51-90008C89
U61	51-90008C42	51-90008C88
U62	51-90008C41	51-9008C87
U63	51-90008C40	51-90008C86
U64	51-90008C39	51-90008C85
U65	51-83625M70	51-90008C84
U66	51-83625M70	51-90008C83

Step 4. Cut trace from feed-through at U58, pin 1 on component side.

Step 5. Insert PAL for new memory configuration (part no. TRN9679A) in U58 socket.

10.2.2 Connect RAM U66, pin 24 to +5 volts instead of VB+ as follows. (Refer to Figure 8.)

Step 1. Cut broad trace near U66, pin 1 between U66 and U67 on component side.

Step 2. On solder side, run a short jumper from U66, pin 24 diagonally to JU12A (+5 V).

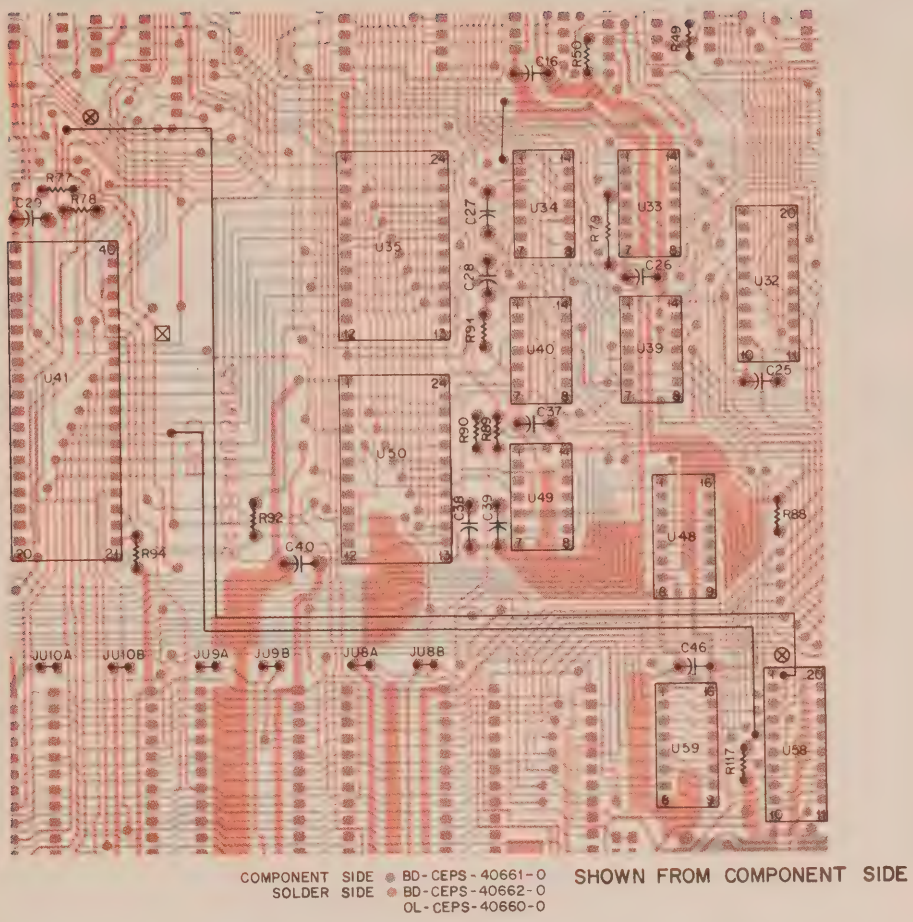

Figure 7. Site Controller Board Module TLN2595A Partial Circuit Board Diagram Showing PAGE2 Signal Rerouting Detail

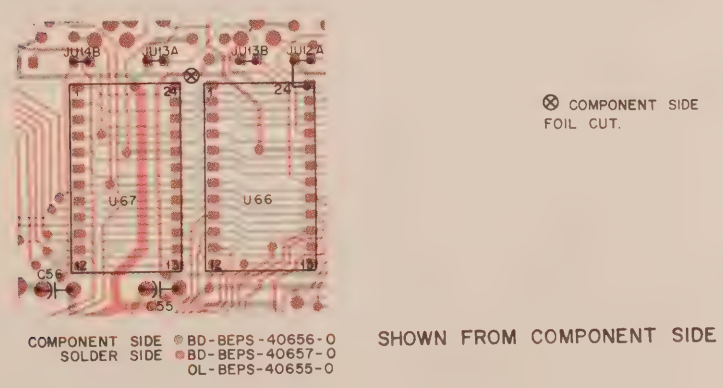

Figure 8. Site Controller Board Module TLN2595A Partial Circuit Board Diagram Showing +5 V Connection Detail

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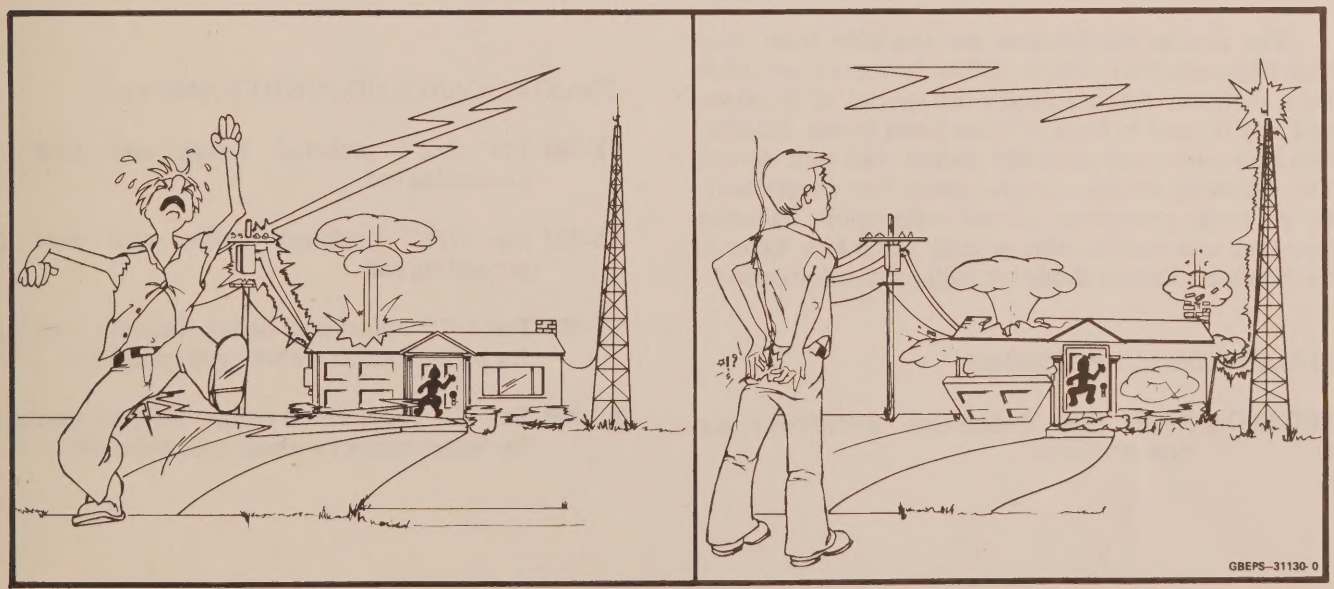
LIGHTNING PROTECTION RECOMMENDATIONS

The conditions that make a site desirable for two-way radio are the same as those that make a site an excellent target for lightning. Proper lightning protection can completely prevent equipment damage in all but the most severe strikes and even then keep the equipment damage at a minimum. Lightning protection basically consists of preventing the strike from entering the equipment room and then preventing damage to the equipment from induced voltages and currents on power and control lines to the equipment. The following suggestions will help protect valuable radio facilities. Some products already incorporate certain suppressors as standard equipment. In these cases, additional protection is not normally required, unless dictated by unique site considerations. When such unique situations occur, consult the appropriate area office for further information.

- Keep the tower grounding resistance as low as possible. The lightning stroke current belongs in the tower structure and grounding system, not on the transmission line.
- Use at least eight-foot long copper clad ground rods. Multiple ground rods are better than one especially in dry climate or sandy-rocky soil areas.
- Bring the transmission line off the tower with the sharpest bend permitted by the manufacturer's specifications and make a solid bond between the tower and transmission line sheath just prior to the bend. The sharp bend acts as a spot impedance to the extremely high strike current. This shunts more of the strike current into the tower ground rather than into the equipment. Use no more or no less than the minimum bend radius wherever the transmission line changes direction and introduce a change of direction at every reasonable opportunity. Then, ground the transmission line sheath at the antenna side of each bend in the transmission line.
- Provide additional grounding to the transmission line sheath wherever possible. Make it a point to ground the transmission line where it is supported on poles and where it enters a building.



Unprotected power/control lines and antenna installations can be hazardous to equipment and personnel.

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- It is wise to take at least part of the transmission line through a length of grounded conduit.

- ***Bond all equipment cabinets together to a single point.*** Then, ground that point to a grounding rod network using as short and as straight a ground wire as possible. If bends in the ground wire are necessary, make them as large a radius as practical.

- Transmission lines should be brought into the equipment cabinets adjacent to the single point ground connection where a good low impedance bond can be made with the transmission line sheath.

- Install a gas tube protector between the equipment cabinet ground and AC-neutral where it enters the equipment cabinet. Install gas tube protectors where the control lines enter the building and at the point of entry into the equipment cabinet. Also, install gas tube protectors wherever control lines enter a building and install additional protectors as close to the remote control console as possible.

- Keep ground wires from gas tube protectors to ground rods or perimeter grounds as straight and short as possible. Avoid sharp bends in ground wires.

- Never bundle a ground wire with any other cabling or wiring. Also, never run a ground wire along any metal wall, along any electrical conduit, or inside a conduit.

Remember, the lower impedance the grounding system is in relation to the equipment being protected, the greater the protection afforded to the equipment. Keep the lightning strike current in the grounding network; not running through the equipment to ground.

RECOMMENDED PROTECTORS

The devices listed below are available from your local Motorola Parts Center. Other devices are available from different manufacturers for special applications and may be used in place of those listed herein. Installation instructions are generally packed with each device. The following listing contains phone line suppressors, ac line surge protectors, coaxial cable in-line lightning arrestors, and coaxial cable ground clamp kits. Refer to the Motorola Buyers Guide for additional information.

PHONE LINE SUPPRESSORS

TRN8187A Single Line Suppressor, 3-electrode gas tube protector

TRN4589A Dual Line Suppressor, 3-electrode gas tube protector

RRX4021B Single Line Suppressor, 3-electrode gas tube protector

AC LINE SURGE PROTECTORS

TLN4399A AC Line Surge Protector, 117 V ac line, 7/8" x 14 conduit hole mounting

TLN5920A AC Line Surge Protector, 240 V ac line, 7/8" x 14 conduit hole mounting

RRX4017A AC Line Surge Protector, 117 V ac, 10 Amp, single phase, screw terminal connector block

RRX4018A AC Line Surge Protector, 117 V ac, 10 Amp, single phase, 3-prong plug and receptacle

RRX4019A AC Line Surge Protector, 117 V ac, 15 Amp, single phase, 3-prong plug and receptacle

RRX4020A AC Line Surge Protector, 220/240 V ac, 30 Amp, single phase

COAXIAL CABLE IN-LINE LIGHTNING ARRESTORS

RRX4024 UHF type connector
RRX4025 "N" type connector
RRX4032 Tower Mount Kit

COAXIAL CABLE GROUND CLAMP KITS

ST-788 For 1/2" jacketed heliax and pipe or grounding rod

ST-853 For 7/8" jacketed heliax and pipe or grounding rod

ST-789 For 1/2" unjacketed heliax, includes bushings for better contact without collapsing line

ST-790 For 7/8" unjacketed heliax, includes bushings for better contact without collapsing line

SYSTEM MANAGER'S OPERATING MANUAL

For Trunked Radio Systems
Models T5004 Privacy Plus™
and T5076 Smartnet™ Central Controllers
and T4051, T4052, and Options D163 and D401
Central Controller &
Central Interconnect Terminal

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